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DIVIDENDS IN SCRIP.

The Western Union Telegraph Company is paying another dividend in scrip in order to avoid paying out cash. This is not an unknown practice in the history of the corporation, for in addition to the action of the same kind last January, it is on record that the company paid a 10 per cent stock dividend in 1862 in addition to 5 per cent in cash. There may be other instances in its long career. The net earnings for the March quarter are placed at $1,100,000, or $400,000 less than in 1907, and if the regular dividend were paid in cash a deficit would be left of $563,000. The question arises whether it would not be better to "face the music" and pass the dividend altogether. The point involved is that the company is not anticipating or paying dividends out of unearned moneys yet unearned, but is, in a sense, capitalizing undistributed earnings that are represented by an accumulated surplus of $14,000,000. In this connection it is to be noted that this dividend which is to come out of the $1,413,000 stock still lying in the treasury, would come under the prohibition of the Public Service Commission if, as is now proposed, telegraph and telephone corporations were subjected to the rule of that body. This new authority has illustrated its point of view by refusing to allow the Erie Railroad to issue ten-year, interest-bearing scrip for the dividend declared on the first and second preferred stocks last August. In this instance the objection of the Commission seems to have been that the issuance of the scrip for such a purpose was really the payment of present dividends out of future earnings, instead of actual earnings in the past; but it is believed that the Commission is broadly against scrip dividends as "extras" or in lieu of cash needed for the conduct of the business. We can well imagine the pride of the Western Union management which would lead it to maintain its long and unbroken dividend record, and there is no doubt that such a sentiment underlies the present action. The company was hit by the late strike to the tune of probably not much short of $3,000,000 all told, and this cannot be made up in a hurry from an industry that has expanded but slowly for years. We understand that very thorough reorganizations and improvements are now being enforced for the sake of economy and efficiency all over the system.

GOVERNMENT REGULATION OF WIRELESS TELEGRAPHY.

The several bills now before Congress for the regulation of wireless telegraphy are an indication of a condition which undoubtedly calls for some action eventually on the part of the Federal authority. None of the present bills, however, appears to represent a sufficiently mature or broad consideration of the subject to which they relate, and the Hale Senate bill is no less than pernicious in some of its provisions. With the ether as a common medium of transmission, which medium can be pre-empted at pleasure by a youth for amateur play, or at any moment rendered unavailable for serious purposes by malicious

disturbances from stations of competing wireless companies, the need of some regulation of its use cannot be gainsaid. The Hale bill, however, would in effect make the ether an instrument of warfare and in time of peace an appanage of the military establishment. It was in this spirit that wireless regulation was discussed at the Berlin conference of 1906, and the international agreement there drafted appears to have very properly been pigeon-holed by the committee of the Senate before which it came for consideration in the form of a treaty. But we now have in the Hale bill an attempt to enact by indirection some of the most criticised features of the Berlin agreement, which are rendered more objectionable by limitations in the sole interest of our military establishment. This attitude recalls the recommendation of a naval authority several years ago, that the coal fields of Eastern Pennsylvania —the source of supply of some millions of people—should be pre-empted for war purposes.

Any regulation of wireless telegraphy should be based on a full recognition of the fact that the art is now in its infancy and that its proper development demands freedom from every unnecessary restraint. Assuming that the government has some sort of prescriptive right to an art with which a long line of scientists and inventors has endowed the world, it does not follow that this right cannot be exercised with due regard to the use of the same art for non-governmental purposes. If in time of peace occasions arise of sufficient importance to call for a temporary pre-emption of the ether by the government, any inconvenience thereby occasioned to commercial and private interests can be borne with some equanimity. But there should be some assurance that such interruptions are incident to matters of real importance—that all private interests are not sacrificed to routine communications that might just as well be transmitted by wire, or by trivial communications between officials. By defining in some manner the nature of government communications by wireless, and requiring a copy of every communication to be filed for critical examination as to its real importance, a gross abuse of the wireless privilege by overofficious or inconsiderate officials would be averted.

In other words, in time of peace the pre-emption of the ether on the part of the government should only be for emergency purposes, and any official making an emergency call should be held strictly responsible for the rightful use of the privilege. In time of war, of course, wireless telegraphy would, in common with all the peaceful arts of civilization, have to resign any claim to consideration; but as a recompense it should not be held in abeyance in time of peace in accordance with what appears to be a policy for the exaltation of the military over the other classes of American people—which classes would be the ones to give their resources and offer up their lives in national defense, and not even balk if the nation should become committed through vainglorious bravado to a war of foreign aggression. None will, we believe, deny the need of some regulation of wireless telegraphy, but the character of such regulation should be the subject of careful discussion in which the interests of the art and of the people as a whole should receive merited attention. A means to this end would be the authorization by Congress of a commission to study the subject and report recommendations, the membership to be so chosen that the military and bureaucratic elements shall not dominate. We sincerely hope that no action will be taken by Congress until the subject of regulation has received in this country much broader and much wiser consideration than is evidenced in the bills thus far offered at Washington.

A New Form of "Efficiency" Photometer.

In our issue of Dec. 2, 1905 (page 942), Messrs. Hyde and Brooks described a form of photometer which not only measured the horizontal intensity of a lamp, but which also directly measured its so-called "efficiency" in watts per candle, a quantity which is really an inefficiency, or reciprocal of an efficiency. In this photometer the carriage was movable and the lamps compared were fixed. A graded resistance coil, shaped like a harp, was used in such a manner that the movement of the photometer carriage to the balance position automatically introduced such resistance into the circuit of a wattmeter as caused it to indicate the watts-per-candle of the lamp under test. In a recent number of the *Elektrotechnische Zeitschrift* appears an article by Herr C. Paulus, abstracted in the Digest, describing a modification of this apparatus, in which the photometer carriage is fixed and the lamp under test is moved. It is shown that a uniform or ungraded resistance coil may be used with this arrangement, thus simplifying the structure. The photometer described is a portable one and gives the watts consumed, the horizontal candles and the watts per candle all by direct readings.

Influence of the Height of Suspension Upon Uniform Illumination.

One of the problems confronting the illuminating engineer is to produce upon a given level surface, either on tables within a hall or on a certain space of ground out of doors, a uniform intensity of illumination perpendicular to that surface. The article of Mr. Alfred A. Wohlauer, on page 601 of this issue, deals with one aspect of this problem. It is really a continuation or extension of a preceding article, printed in the issue of Dec. 21 last, and the two articles should be taken together in order to arrive at a clear understanding of the facts presented In the first article it was shown that in order to illumine uniformly a plane circular horizontal surface from a single lamp suspended, say, immediately above the center, a certain polar curve of intensity was required from the lamp. The intensity would have to be a certain minimum immediately beneath the lamp and then move off toward infinity in a nearly straight line at an angle of nearly 30 deg. below the horizontal. No actual lamp could be expected to give such a distribution of candle-power even as far as 45 deg. from the lower vertical. By means of a suitable reflector, the required distribution might be secured as far as 45 deg., but this would mean hanging a very powerful lamp at a height equal to the radius of the plane surface to be illumined. Consequently, the problem practically resolved itself into the lighting of the surface by means of a number of similar equidistant lamps supported at a uniform elevation. It was shown that there existed theoretically a certain peg-top shaped polar curve which, for a given ratio of elevation to spacing interval, afforded a simple straight line law of diminishing illumination along any line in the illumined plane connecting the feet of perpendiculars below the lamps, the illumination from one lamp falling to zero at the adjacent perpendicular.

It is easy to see that once such a straight line law of falling off in illumination is produced along any radius from a lamp,

the total illumination due to all the lamps will attain the same uniform value at all points on the rectilinear network of lines joining adjacent lamp perpendiculars, or along the edges of squares on the illumined surface having lamps over their corners. Within the squares, the illumination will tend to be somewhat in excess of this value, although the difference would not be serious from a practical standpoint. In the present article it is shown that if we suppose a flat surface to be illumined in the manner above outlined—that is, by means of uniform lamps uniformly spaced at the junctions of a uniform rectangular net—and an upright cord fastened to each lamp over a supporting pulley, for the purpose of adjusting the lamp elevation, then if the polar distribution of intensity is selected for the existing ratio of height to spacing, we know that practically uniform illumination can be produced all over the surface. The illumination of each lamp will fall uniformly from a maximum at the foot of its own cord to zero at the feet of the adjacent cords. Intermediate points will receive illumination from not less than two, nor more than four, lamps.

If now we lower away on all the cords to the same extent, so as to reduce uniformly the elevation of all the lamps, we should no longer secure uniform illumination. It would be greater everywhere, but it would be much greater at each cord than at intermediate points. In order to restore uniform illumination for the lowered lamp level, it would be necessary to change the lamp reflectors so as to produce another polar curve. If, however, we lift away equally on all cords so as to raise uniformly the elevation of all lamps above the original level, we should still retain the same nearly uniform illumination. The illumination from any one lamp would now diminish from a maximum at its own cord, by a straight line law, to zero at a radius greater than the distance interval separating the lamps. At all points on the rectangular network the illumination would be constant and the same as when the lamps were at the original level. In general, the illumination at any one point would be contributed by more lamps than two on the network or than four within the squares. The curious result thus follows that, provided we are not standing near the edge of the illumined surface, the illumination will remain substantially unaltered no matter how far we increase the height of all the lamps above the original level for which their polar curve was provided.

STEAM ROAD ELECTRIFICATION.

One can hardly classify this topic as sensational in its novelty, but in these days it is always timely and worth considering. The discussion which Mr. Fowler contributes to our columns is certainly an interesting one in its bearings on the nature of the electrical equipment, and is a strong plea for the single-phase system on the solid ground of economy. The fact is that in all comparisons of this sort there is substantial failure to agree upon fundamental data and even upon corresponding modes of thought. Every comparison with respect to steam-road electrification is faulty in its basis because thus far it seems to have been practically impossible for the advocates of steam and of electric traction to argue upon a common plane or to talk the same language. For example, Mr. Fowler's thesis practically reduces to the following: If a railroad wants to do electric interurban work it can do it cheaper and better by electricity than by steam. To which the steam road advocate responds that he'll be hanged if he wants to do electric interurban work and that for a first-class local service by steam locomotives the steam locomotive is indubitably the proper thing.

With this difference between the basic proportions the data can hardly be expected to be closely coherent. In the article before us the costs per train-mile by steam and per car-mile by electricity have really nothing more to do with each other than the prices-current for Portland cement and for glue; and this although Mr. Fowler is unquestionably right in his contention that for efficient local passenger service electricity is decidedly the best and cheapest motive power, which indeed most steam railway men are willing to confess if not twitted with the unpleasant fact. Experience has already proved the deadly character of the electrical competitor. As to single-phase vs. "standard" practice, we have for years been trying to hammer home the fact that working conductors at 500 to 700 volts are unscientific and uneconomical for the distribution of electrical energy over anything but trivial distances, and we rejoice with Mr. Fowler at the success of some of the high-voltage single-phase systems, particularly in the far West. Our friends out on the Coast have a way of going ahead and doing things that is very gratifying. Everything points to the steady improvement of the single-phase system, which is now passing through the stages of evolution that seem necessary in the growth of every new thing. Just how far it can be utilized in general tramway work is as yet problematical, but it assuredly is doing capital work on some of the interurban lines.

Truth to tell, the chief obstacle in the more general application of electricity to railway service is financial rather than technical or operative. If one were the president of a big railway system and had been struggling strenuously for a couple of decades to pay dividends on his stock with the water spigot always open, and the printing presses working overtime getting out subsidiary securities to purchase other people's private reservoirs before they could undermine your own, he is apt to be brought to the verge of nervous prostration upon seeing looming up ahead the need of re-equipment to be paid for in real money. And particularly when he realizes that a lot of fellows are prowling around trying to dynamite his reservoir walls. To be entirely serious, there is little doubt that a good many roads see the necessity for "electrifying" part of the service and would be glad to do so were it not for the difficulty of financing the proposition in these days of unsettled railway values and the possibility of further and more serious disturbances before things settle down to a more stable condition. All the things which are now apparent, well trained railway men have seen approaching for some time past. It is little to be wondered at that they have thought it best to make haste very slowly, particularly in view of the radical changes in transportation methods that would be likely to follow in the train of electrification and which would involve some experimenting on a colossal scale. From a purely technical standpoint Mr. Fowler and other engineers who have discussed the subject have made out a very strong case, and the course of events is steadily proving it. It will take much time, however, to bring about the changes that sooner or later must come. It is necessary first that the railroad business should get out of its present sorry condition into one of reasonably permanent stability. Then in due season the changes will come, and in the interim they will become easier and cheaper to make.

Public Service Rate Decision.

Judge Hough, of the United States Circuit Court of the City of New York, declined, last week, to fix a rate at which gas could be sold in New York City. The United States Court had previously decided that the 80-cent rate fixed by the Legislature was confiscatory, and an application was made to the court to fix a rate that would be constitutional; this was declined on the ground that such action would be contrary to the oft-repeated opinion of the highest court in the country that no court can fix a rate. Judge Hough intimated that the whole matter would have to be carried before the United States Supreme Court. Under the 80-cent gas law, and within the entire valuation which he had fixed, the net income would be less than 6 per cent, and the rate of 6 per cent was stated to be "the lowest rate in the City of New York that could be considered legislatively fair to those who are already engaged in the manufacture and supply of gas and cannot readily escape therefrom."

The Peoria Electrolysis Suit Again.

The suit in equity of the Peoria Water Company, controlled by the United Waters Company, of Boston, against the Peoria Railway Company involving damages to the plaintiffs' water pipes by electrolytic action of stray return current from the defendants' lines, which was begun about 10 years ago, had another hearing before Special Master Frank L. Wean, in Chicago, last week. Ten years ago a special master of the United States Circuit Court, sitting on the evidence presented, made a report in favor of the plaintiffs. No action was taken by the court on the master's report, and last October the Peoria Water Company again applied for argument on the case. The defendants agreed to another hearing before a special master at which new evidence could be submitted, and their case was presented last week. On the conclusion of the hearing of the defendants' evidence, the case was adjourned until April 7, when the plaintiffs will present their side of the case. No final decision of the court is expected before the next fall term. If the report of the master is favorable to the plaintiffs, and the court approves the finding, an injunction will be issued against the defendants, enjoining them from using the single trolley, which will be the same in effect as the issuance of a writ of mandamus, compelling the defendants to use the double trolley.

The case is important because it is the first which has been brought in the United States Circuit Court, and because the United Waters Company, of Boston, which is back of the plaintiffs, owns a large number of water plants throughout the United States. The plaintiffs were represented at the hearing by D. C. Mauray, chief engineer of the Peoria Water Company, who is recognized as an authority on the effects of electrolysis. The defendants were represented by Judge I. C. Pinckney, attorney of record, and Edward E. Winters, consulting engineer, of New York, who presented the technical arguments and evidence.

Adverse Report on Hydro-Electric Development Near Minneapolis.

A commission consisting of Majors Judson and Kimball, of the United States Army, and Mr. J. E. Woodwell, have made a report to the Secretary of War adverse to the present development of electric power in connection with dams now completed or under construction by the United States between St. Paul and Minneapolis, Minn., the primary purpose of the dams being to assist navigation on the upper Mississippi. Several propositions for utilizing the heads rendered available by the dams are discussed, and are reported against on the grounds that any development made at the present time would be of relatively small generating capacity, and would stand in the way of a future comprehensive development. The commission believes that within 20 or 25 years, and perhaps within a much shorter period, it will be economically desirable that there be erected a high dam at the lowest suitable point between St. Paul and the site of one of the present dams, the backwater from which would extend to the lower tailrace at Minneapolis. In this way there could be obtained a head of probably 35 ft. at lower stages, and it would be practicable to develop from 15,000 to 20,000 horse-power.

Electric Light Rate Ordinance in Chicago.

For some time an ordinance relative to electric lighting, power and heating rates which may be charged by the Commonwealth Edison Company has been under consideration in Chicago. The rate ordinance as recommended to the Council by its committee on gas, oil and electric light, authorizes until next August a gross maximum rate for lighting of 15 cents per kw-hour up to the equivalent of 30 hours' use per month of the customer's maximum requirements, and 9 cents for energy used in excess of that amount. This is the company's present rate. One cent per kw-hour discount is now given for prompt payment within 10 days from date of bill. After July 31, 1908, the rates are to be 13 and 8 cents, and for the last three years of the period covered by the ordinance, from Aug. 1, 1909, to July 31, 1912, the rates are to be 13 and 7 cents. For power the rate is prescribed as 11 cents per kw-hour for the first 30 hours' use of the maximum demand, and 6 cents for energy used in excess of this. The minimum charge is to be 50 cents per horse-power per month. The proposed ordinance has brought out considerable discussion, in which nothing showing the rates to be otherwise than fair has been presented.

In a discussion of the ordinance which was held at the City Club, President Insull gave the rate at which the street and elevated railways of Chicago are supplied. These companies pay $15 per year for each kilowatt of maximum demand as a readiness-to-serve charge. This maximum demand is measured at the switchboard of the company's generating plant at Fisk Street. In addition to this, ½ cent per kw-hour is paid for all energy required, as measured at the generating station. It was further stated in this discussion that the company loses money on the business of small offices and apartments, but makes it up by a little higher charge to the big consumers, a point generally recognized by students of the problem.

Light and Color in Decoration Discussed in Chicago.

The Chicago Section of the Illuminating Engineering Society discussed the paper by Mr. George L. Hunter on "Light and Color in Decoration" on March 12. The meeting was held following dinner in the Breakfast Room of the Grand Pacific Hotel. Mr. Frederick J. Pearson opened the discussion with some remarks to the effect that the aim should be to follow as nearly as possible the color and illuminating effects found in nature. He cited examples of those dealing in decoration who had been most notably successful and who followed nature's colors.

Chairman Cravath presented a written discussion, explaining that in many cases the illumination on walls and ceilings might be considerably reduced without impairing the general effect, and that by so reducing this general illumination and directing it to particular places in a room where higher illumination is needed, the results are much more satisfactory to the user. He gave one well-known practical example of this. Illuminating engineers were not especially interested in illuminating the floor as a floor, because light directed in the direction of the floor was useful for practical purposes on objects placed between the sources of light and the floor. He thought it well, however, that Mr. Hunter had called attention to the importance of properly lighting walls and ceilings, because some might carry the idea of reducing the illumination in these parts of the room too far.

New York Subway Signal System.

In an exhaustive report upon the subject of the signal and interlocking system in use in the New York subway, Mr. Bion J. Arnold has recommended to the Public Service Commission that improvements be made in the signal apparatus by which less headway for express trains may be obtained without sacrificing the safety of passengers, and that after these improvements are perfected, the local tracks be equipped with the same block-signal system as is now used on the express tracks. Mr. Arnold also criticises the present plan of express stations, and says that if they were double-decked or otherwise planned to allow the movement of express trains alternating on one and the other side of express platforms, the capacity of the subways would be increased fully 50 per cent. The signal changes he recommends would make possible a headway of 90 seconds, or 40 trains an hour, on both express and local tracks. At present the rate is about 30 trains an hour.

As a temporary means of increasing the efficiency of the existing signal system, Mr. Arnold suggests a visual and audible signal to be given by the stopped train to a subway platform station attendant that the entering train has been delayed to the extent of a full stop. He also suggests a manually-operated switch whereby an attendant can release the emergency stop holding the entering train and giving it the signal to proceed after the leaving train has begun to move. Much time is now lost, he says, because the proceed signal is not given to the motorman of the entering train until the last car of the leaving train has left the platform.

In regard to the signal system for the local tracks, Mr. Arnold says that the only difference between train movements on the different tracks is that more frequent stops are made by local trains. As the introduction of more frequent stops between the terminals introduces a risk, the need for safety signals on the local tracks is really greater than it is on the express tracks. "It would, therefore, appear," he says, "that if the practical degree of safety decided upon for subway operation demands the installation of the signal system and automatic stopping devices on the express tracks, the same or similar equipment is necessary on the local tracks."

Mr. Arnold's conclusions are as follows:

(1) The subway signal system is in the main modern, effective and well maintained.

(2) There is no reason, so far as the signal system is concerned, why a 90-second headway cannot be maintained.

(3) This 90-second headway will eventually be desirable upon both local and express tracks.

(4) The signal system at the present time does not afford positive safety at the approach to stations, as the motormen are relied upon to reduce the speed of the trains.

(5) In addition to the excessive platform waits additional time is lost at each station stop by holding the following train a considerable distance out of the station until the leaving train has entirely cleared the platform.

(6) As at present operated delays at the station platform have a cumulative effect upon the following trains so that even one prolonged stop may disarrange the schedule for the entire hour.

The report recommends the following changes:

1. That the necessary steps be taken to develop and install an automatic speed-control signal system to be used as an auxiliary at station blocks which will allow the incoming train to safely approach the rear of the train at the platform and to enter the platform promptly upon the leaving of the outgoing train without sacrificing any of the standard of safety which is now maintained between stations.

2. That during the development of the system there be installed at every express station the changes in the block-signal system proposed by the Interborough Company for Grand Central Station. The equipment required for these changes will reduce the present possible headway by seven seconds, and could ultimately become a part of the permanent recommended arrangement.

3. That the subway officials consider for the purpose of effecting temporary relief the installation of a manually operated permissive signal at every express station to be used to expedite a delayed incoming train and thus overcome the cumulative effects on the schedule of a prolonged station wait.

4. That the local tracks be protected by a complete block-signal system, when the automatic speed control system herein suggested has been perfected.

5. That, when the load on the subway increases to such an extent as to require additional conductors for carrying the electrical energy to and from the trains, the present signal system be altered so as to utilize both rails for carrying the return current, and at the same time make the system conform to the latest accepted practice whereby the signal system detects and indicates a broken or removed rail, provided the system shall at that time have proven superior to the single-rail system.

Wireless Companies Oppose Hale Bill.

Characterizing the Hale bill, introduced in the United States Senate on March 6, as the third in a series of attempts to get around a promise of the leaders of the House, who, it is said, had agreed to shelve action on the recommendation of the United States delegates to the International Wireless Telegraph Convention held in Berlin, November, 1906, both the Marconi Company and the United Wireless Telegraph Company are bitterly opposed to the Hale measure in its present form.

Briefly, the Hale bill empowers the United States government to control and regulate all wireless communications in the United States and its possessions. The government would stop doing all commercial business now carried on under a section in a circular issued by the Bureau of Equipment of the United States Navy. It would make it incumbent upon commercial companies to obtain licenses for each vessel and land station equipped, the license fee being 5 per cent of the cost of equipment. Interference would be a penal offense punishable either by a fine of $2,000 or a year's imprisonment, or both. It leaves the zone of transmission which would be free to the jurisdiction of each state, thereby making it incumbent on each state to pass laws covering the matter of zones. The part of the measure which has caused the greatest amount of protest is section 8, as follows:

"That it shall be the duty of every person or corporation using or operating a wireless telegraph apparatus pursuant to a license granted under this act to answer wireless calls and signals from and for any other person or corporation so licensed; to receive all messages or signals tendered for transmission to any other neighboring or connecting apparatus, and at the price customarily asked and received for such service; to transmit the same to such neighboring or connecting apparatus without discrimination and without regard to the system of telegraphy by which such calls, signals or messages are made, and a neglect or refusal to observe the requirements of this section when practicable, shall be cause for revocation of license."

"This section clearly shows," said Mr. S. S. Bogart, vice-president of the United Wireless Telegraph Company, "that the intention of the bill is to cover the same grounds provided by the Berlin treaty and now held in abeyance by the Senate."

There are two other wireless bills before the House at present, one introduced by Mr. Shepard and another by Representative J. Peters, of Massachusetts, which, if passed, would have the effect of making wireless telegraphy a government monopoly. In the second section of the Peters bill it specifically provides that the use of magnetic waves of 374 to 425 meters is prohibited except for official stations. "The passage of this bill," Mr. Bogart said, "would throw out all long-distance commercial stations and practically would make wireless telegraphy inoperative." The Shepard bill provides that the originating or transmitting of false messages purporting to be official is a penal offense, and this section receives the approval of all the

companies. But sections 5 and 6, to break in or interfere with any wireless station transmitting official messages, are not so well understood. As a matter of fact, it would be extremely difficult, if not impossible, for the United States government or the state governments to pass laws preventing interference. All this legislation, or rather attempted legislation, by those who have no adequate knowledge of the subject with which they are attempting to deal, is entirely unnecessary. Should these measures be passed, the government should have a general signal that would permit it to break in and take the circuit when commercial messages being sent are concluded, which signal should be recognized by all companies, and also an emergency "break-in" signal. Then the government should compel all the companies to recognize a certain distress signal no matter when or by whom it was given.

Vice-President Bottomley, of the Marconi Company, said that, in his belief, the bills represented an attempt of the government to establish a monopoly, and that the government was controverting its past policy of keeping clear of the field of commercial enterprise.

The Long Acre Company Hearing.

The Public Service Commission, investigating the electric light companies of New York, held a second meeting last Thursday to consider the affairs of the Long Acre Company. Mr. Walter H. Knight, chief engineer of the Long Acre Electric Light & Power Company, corrected his previous testimony to read, that of the amount of outstanding bonds of the company $500,000 of the $1,000,000 signed had been sold and $100,000 hypothecated as collateral to the agreement between the Long Acre Company and the American & British Manufacturing Company. Mr. Knight stated that the Long Acre Company gave the formal order for labor and materials for the construction of its power plant July 3, 1907, and purchased the present plant Dec. 16, 1907. The contract between the Long Acre Company and the American & British Mfg. Company requires the Long Acre Company to employ the American & British Company to furnish all materials, and to furnish and perform all the work and labor necessary to the construction of the Long Acre plant at a profit of 15 per cent. As general collateral the Long Acre Company deposited $100,000 of the face value of the first mortgage 4 per cent bonds. Mr. Knight testified that his company had no receipts for the year ending June 30, 1907, and that there were some expenditures in connection with incorporation matters, but he could not say whether or not these expenditures had been reported to the Commission.

Mr. Henry W. King, counsel for the Long Acre Company when the franchise was purchased, said he had been unable to get the books of the old American Electric Manufacturing Company, but that he did get trace of the books of the American Electric Illuminating Company at the time when this company went into the hands of Receiver John M. Ward. At Mr. Ward's death the books were lost and have not yet been recovered. During his search for these books he said that he had learned that in 1889 the American Electric & Illuminating Company had operated a plant in East Twenty-fifth Street on Avenue A, extending through to East Twenty-fourth Street, in which were two arc dynamos of 50-light capacity, and wires had been strung down Avenue A to Houston Street. The terms of the franchise stated that certain compensation should be paid to the city, "one full arc-light of power equal to the average required at the time, in contracts with the city for such electric lights, for every 50 arc lights furnished by the company to consumers." Mr. King said that the Long Acre Company has never supplied lamps to consumers, but that under the terms of the contract four arc lights had been supplied by the American Company to the city, and, at the time mentioned, the company was supplying 90 arc lamps to private consumers. The franchise also provided that a sum equal to one cent for each lineal foot occupied by the company in the streets, should be paid to the city, but it was brought out that there was nothing to show that such payment had been made, and that the Long Acre Company has not made any such payments. Mr. George E. Bouchie, who voted 490 shares of the Long Acre Company, was trustee for the Manhattan Transit Company, Mr. King testified. Other individuals who held shares, owned them in their own name, with the right to dispose of them, but with the moral obligation, according to Mr. King, not to sell them. Mr. King said that the 490 shares were not loaned by the Manhattan Company for the purpose of voting.

Mr. Knight was recalled to the stand and stated that the company had been engaged in constructing a small central power plant and placing ducts to street conduits. At present the company was engaged in making subsidiary connections to its customers, with a view to supplying them with current from the power plant situated on Second Avenue and Forty-seventh Street. At this time, he said, only the Manhattan Transit Company was connected to mains of the Long Acre Company. The Consolidated Subway Company had constructed one-half mile of subway, and six or seven house connections had been made on the west side of Second Avenue, from the south side of Forty-second Street to the north side of Forty-eighth Street. The income to the Long Acre Company from the Manhattan Transit Company was about $400 or $500 a month. He testified that the Long Acre Company had been formed four years ago, not with the intention of purchasing an old franchise, but of getting a new one, which could be operated in the area included between Thirty-third and Fifty-ninth Streets. When the corporation was unable to obtain a new franchise from the Board of Aldermen, its attention was called to the old franchise. Mr. Knight said that since Jan. 15 he had become a stockholder in the Long Acre Company to the extent of one share. Among other constructions planned in addition to the one at Forty-seventh Street and Second Avenue, was a substation storage-battery station at that point. When asked how many new contracts with consumers had been made, he said that they had engagements for six or seven customers on the block bounded by Second Avenue, Forty-eighth and Forty-seventh Streets, and an offer to supply power to the Criterion Theater when the theater's present contract expired, which would be around the beginning of 1909. He thought the income from the Criterion Theater would be about $500 a month. The connection between the Manhattan Traction Company and the Long Acre Company was that the former owned 490 shares of stock of the latter, and that the Long Acre Company was situated on the property of the Transit Company. There was no litigation by the Long Acre Company for or against it, Mr. Knight said.

Mr. W. H. King gave the following inventory of the Long Acre Company, which was taken Feb. 1, 1908: Two 75-hp Diesel oil engines; one 5-panel main switchboard; two 6-in. kw generators; six wattmeters; one 10,000-gal. oil tank; two 10-hp motors and regulators; one ½-hp motor and regulator; one lot enclosed fuses; 1200 ft. lead-covered cable; wiring and connections to cable. The total valuation of the inventory was placed at $1,600. This, added to the cash in the treasury of $18,010.24, gives a total of $34,010.24.

When asked what advantages the consumers would derive from the new company Mr. King said that "competition is the life of trade," and if this were not so the old electric companies would not have combined. The consumers would have an open market, and the Public Service Commission could prevent the Consolidated Gas Company from getting control of the Long Acre Company, preventing the transfer of stock. He said it would not be the policy of the company to sell current below cost, but that it could sell at a profit and still sell at lower rates than the rates prevailing at present. The guarantee that an exorbitant price would not be charged was that such a price would kill itself by competition. He believed that the corporation laws of New York were not sufficient to prevent individuals who owned stock in the Consolidated Gas Company from buying up the Long Acre stock

and thus virtually controlling both companies, and added that there might be two or three ways whereby competition could be eliminated. Mr. King called Commissioner Maltbie's attention to the fact that the Long Acre franchise is the only existing franchise not controlled by the Consolidated Gas Company, and said that if the commission refused to allow the Long Acre Company to go ahead, the matter of competition was settled for all time in New York City, as his experience had shown that it was practically impossible to get a new franchise from the Board of Aldermen. He believed that the Long Acre Company could sell current at a considerably less rate that the present 10 cent per kw-hour maximum, and thought he would be willing to have some contract clause in the franchise to sell current at a less ratio to the cost of production than that existing at present. He was of the opinion that the demand for lower prices created by competition would stimulate inventive activity, which would lessen the cost of production and distribution. The hearing was adjourned to March 17.

Electric Haulage of Canal Boats.

A paper by Mr. Lewis B. Stillwell and Mr. H. St. Clair Putnam, read at the meeting of the American Institute of Electrical Engineers on March 13, reported the results of tests on the electric haulage of boats along the Lehigh Canal near Mauch Chunk, Pa. The boats used in the tests weighed from 135 to 139 tons loaded, and from 23 to 24.2 tons when empty. The energy consumption in watt-hours per ton-mile varied from 11.3 with four loaded boats at an average speed of 1.4 miles per hour to 20.0 with one boat at an average speed of 2.81 miles per hour, when a direct-current locomotive was used; when a direct-current traction was employed the consumption for four loaded boats was 12.0 watt-hours per ton-mile and 21.0 watt-hours for one boat. Special tests showed that the efficiencies of the locomotive and the tractors were almost equal, that of the locomotive being slightly higher. The authors suggest that the maximum speed between locks should be chosen as four miles per hour with one loaded boat and three miles per hour with four loaded boats. They estimate the total time in transit over 106.2 miles of canal, including locking, to be 160 hours with four boats and 75 with one boat.

In the discussion which followed the reading of the paper it was pointed out that, in view of the agitation for interior waterways, the question of electric haulage was opportune. Mr. Richard Lamb drew attention to the fact that canal transportation is essentially and always will be very slow, because of the shallowness of the water in the canals. If speeds are increased, the bow wave damages the banks and at a certain speed the canal boat absolutely stands still, touching bottom. Dr. Steinmetz, speaking from casual observations made of traffic on the Erie Canal, said that while mule power was antiquated, it was a question whether under actual conditions of operation mule haulage was not more economical than electric haulage. He also called attention to the fact that canals being public waterways, electric propulsion could not be insisted on to the exclusion of mule or steam propulsion, or any other established methods of propulsion. Moreover, canal traffic is intermittent and equipments designed to take care of the maximum traffic would probably be idle during certain parts of the year and run uneconomically during other parts of the year. He likened a canal to a country road on which a trolley line is built. There was not much traffic on the country road, because the traffice went over the trolley line; but the country road was maintained nevertheless for possible use. If electric haulage on canals were to show a superior efficiency, it would be because a new volume of traffic was created. Mr. Stillwell in summing up said that the subject of mule versus electric power was investigated by Mr. Putnam, and the results showed that if a canal were working at anything approximating to its full capacity, electric haulage in general would pay handsomely.

March Meeting of the New York Section of the I. E. S.

In a paper on "The Relation of Illuminating Engineering to Architecture from the Engineer's Standpoint," read before the New York Section of the Illuminating Engineering Society on March 12, Mr. E. L. Elliott stated that there is a very considerable degree of feeling among modern architects that the engineer and his work constitute a sort of necessary defilement of the rarefied spiritual atmosphere in which they should by right dwell. The modern architect seems to have only anchorage in which he has implicit faith and that is veneration for antiquity. The much admired ancient structures were wonderful embodiments of the highest degree of artistic taste and originality, but they remain as monuments of the most debased form of human labor conceivable, namely, hopeless and abject slavery. Strictly speaking, there are no remnants of any ancient structure which show the application of true engineering principles. Building to-day has become almost entirely an engineering problem; and with the vast increase in the complexity of life which characterizes modern civilization, has arisen the necessity of subdividing the general problem of construction into a number of distinct branches. Among these are the purely mechanical construction, which has given rise to structural engineering; the methods of heating and ventilating, with its special engineering; electrical equipment, with its electrical engineering; provisions for sanitation, with its sanitary engineering; and lastly, the necessities for artificial illumination, demanding illuminating engineering. All but the last mentioned of these special branches of engineering have gradually been necessitated in the evolution of building, and have been accepted by both architect and client. It is only the last that is still to some extent in the undeveloped state. The advent of the illuminating engineer as a specialist should be hailed with greater delight and relief by the architect than by any other member of the community. Having satisfied himself of the competency of the illuminating engineer, just as he would satisfy himself of the competency of the electrical, or construction engineer, the architect can turn over the plans of the building, with the specifications of the use or uses to which it is to be put, and probably also a statement of the illuminant to be used, and leave the entire technical problem to the illuminating engineer. A careful analysis of the respective provinces of the illuminating engineer and the architect discloses no more ground for mutual disagreement and distrust than between the architect and any other engineering specialist.

In opening the discussion Mr. Bassett Jones, Jr., explained that Grecian structures represent the highest attainment in architecture, because they were erected at a period when man was best able to appreciate true beauty, and in a locality where beauty was demanded by the general public. The best examples of architecture in modern buildings are found in those copied as faithfully as possible from Grecian structures.

Mr. W. H. Gardner remarked that the appearance of many of the modern buildings fails to please because of the complicated decorations. Beauty in architecture reaches its highest type when simplicity is adhered to.

Mr. A. J. Marshall expressed his dislike for contentions among the various interests represented in the membership of the society, and stated that best results will be obtained when the architect and the illuminating engineer reach a mutual understanding as to the duties that each should perform.

Mr. Elliott said that his paper was intended to point out the true condition of artificial illumination, to outline the points of difference as viewed by the architect and the illuminating engineer and to register a plea for more effective co-operation.

Mr. Norman Macbeth illustrated and described an original device for calculating illumination. The device, based on the so-called "inverse-square" law, allows either the illumination, the candle-power or the distance to be determined provided two of these three quantities are known. It consists of a logarithmic slide rule arranged in disk form for convenience in gradation. One of the scales (height) is arranged in

"inverse" order, so that multiplication is equivalent to division by the square of the number indicated. Another concentric scale shows what multiplication factor is accounting for the cube of the cosine of the angle of deviation from the normal to the plane to be illuminated.

Zambesi-Johannesburg Transmission.

At a meeting of the Pittsburg Section of the American Institute of Electrical Engineers, held on March 4, at which there was an audience of more than 400, Mr. Ralph D. Mershon explained the commercial features of the Zambesi-Johannesburg transmission scheme. At the present time there is used along the Rand, near Johannesburg, power amounting to 65,000 kilowatts. The Zambesi Falls, which are 2.5 times as high as Niagara, can supply at least 225,000 kilowatts at low water. The Victoria Falls Power Company expects eventually to transmit energy from the Falls 700 miles to Johannesburg. In order, however, to eliminate the heavy investment which would be required if energy were to be transmitted at once from the Falls it has been suggested to construct a steam-driven generating station near Johannesburg for use during the period of building up a market for a large amount of electrical energy. Although the Thury direct-current system has been proposed for the 700-mile transmission system, it is probable that an alternating-current system will be adopted.

Chicago Lamp-Post Competition.

The Chicago Architectural Club recently held a prize competition for the design of a street lamp post, bracket and pedestal. The prizes, amounting to $200, were given by the Commonwealth Edison Company and James B. Clow & Sons. It was specified that the post shall be designed for incandescent lamps of 75 and 100 horizontal candle-power, the number of arms on the post to be not less than two nor more than four, with possibly an extra globe on top. This competition was started because of the interest that was being taken in improved street lighting in Chicago. The competition brought out eight designs. Most of these, it appeared in the discussion which followed the award, were rather too elaborate for economical production in cast iron. As to the arrangement of lamps, that adopted by most of the competitors was to hang lamps pendent on the ends of four arms and place one lamp upright on top of the post.

Additions to New York Central Electric Equipment.

The N. Y. C. & H. R. R. R. has decided to increase its equipment of electric locomotives for its New York suburban traffic. For this purpose it has ordered from the General Electric Company 12 direct-current locomotives to be delivered in about six months. These locomotives will be similar to those now in use for bipolar 600-volt motors receiving energy from an inverted third rail.

CURRENT NEWS AND NOTES.

NATIONAL CONFERENCE ON STANDARD ELECTRICAL RULES.—The annual meeting of the National Conference on Standard Electrical Rules will be held at the Edison Auditorium, 44 West Twenty-seventh Street, New York, on Friday, March 27, at 1 o'clock in the afternoon. This meeting will follow that of the electrical committee of the Underwriters' National Electric Association, representing the National Board of Fire Underwriters, and will consider changes made in the National Electrical Code.

A WELCOME TO PHOENIX.—The board of trade of Phœnix and Maricopa, Ariz., telegraphed recently Mr. T. A. Edison, on his recovery, offering him "free of all charges the use of the best residence obtainable furnished in this city, together with a carriage and coachman for as long as he will honor us with his company." This generous offer, with details as to the charms of the place, was sent to Mrs. Edison with the remark: "We reverently invoke the grace of God upon our great countryman in this hour of his trial, and affectionately urge his acceptance of our hospitality." All of which is extremely handsome, but Mr. Edison believes he can find greater seclusion and rest on his own plantation in Florida.

PUBLIC SERVICE COMMISSIONS VS. MUNICIPAL OWNERSHIP.—Mr. Glenn Marston, the municipal statistician, gave a lecture on "Public Ownership and the Public Service Commissions" before the students of Hobart College on March 6. Mr. Marston said that the commissions in New York and Wisconsin are formed under the most advanced laws for public regulation in the country. Their power over lighting companies enables them, on proper complaint, to give the public all the advantages which can be derived from competition without the possibility of future high rates when the competitors come together. The main part of his address was given to a discussion of the check on public ownership which has followed the creation of the public service commissions. In states where commissions exist all the objects sought by public ownership advocates are accomplished through public control without risking a large amount of public money in a commercial venture which usually turns out unprofitable.

GOVERNMENT ELECTRICAL TESTING.—The British Government has approved the recommendations of a committee which was appointed to determine if the National Physical Laboratory competes unduly with private enterprise in commercial testing work. The committee in its report classifies commercial testing under two heads, "contractual" and "investigatory." The former means ordinary testing of materials to see whether they meet the specifications of a particular contract; investigatory testing covers all other testing work. The committee leaves the Laboratory free as regards the latter; as regards contractual testing, it reserves this for private enterprise as a general rule, with the following exceptions: First, the Laboratory can take any work for which private establishments are not equipped. Secondly, it can take any work that is sent to it by arbitrators, judges or disputants. Thirdly, it can take work for government departments. As a further safeguard it is recommended that where the same tests are carried out in the Laboratory and also by outside parties, the fees of the former should be at least as high as the current rates; while in the case of reference testing (i. e., to settle disputes) they should be distinctly higher. The Laboratory should also charge much higher fees when it is asked to defer publication of the results for a period of years.

METALLIC-FILAMENT LAMPS IN ENGLAND.—According to our London contemporary, *Electrical Times,* the use of the metallic-filament lamp in England has spread consternation among the gas companies. In replying to statements in the press relating to the effect of the new lamp on the gas industry, representatives of the latter "have written pathetically earnest letters of remonstrance, pointing out that gas really is *not* dearer, that it really is *not* more unhealthy, that doctors swear by it, and so on. Gas managers no longer talk so glibly about '5 or 10 times the cost.' They have been pulled up with too painful a jerk to carry on the tale—except when treating with obvious simpletons." The claim having been made that a 64-cp gas mantle only takes 3 cu. ft. of gas per hour, it was met by a central-station manager, who said that he finds 5 cu. ft. is the average consumption, and 30 or 40 candle-power the average illumination. Our contemporary continues that the gas challenge is now, "Come and compete with us in the laboratory." "The tables are turned. The gas companies used to tell us contemptuously that the public had no use for laboratory tests, they wanted practical results. Yet now the challenge of the same people—not to prove that gas is one-tenth the cost, but to prove it merely equal value for the same money—is couched in terms that are applicable only to the gas tester's laboratory at the gasworks."

TELEGRAPH POLES IN PHILADELPHIA.—The Philadelphia Council has passed an ordinance giving the chief of the City Electrical Bureau the power to cut down the wires and poles of the Postal Telegraph Company should that company fail to pay to the city a $16,000 claim within 30 days.

PUBLIC SERVICE STOCK DIVIDENDS.—The Public Service Commission of the Second District of New York has decided that it is not lawful for electric corporations to issue stock in payment of dividends. The decision was in a case involving the Babylon Electric Light Company, which had asked for authority to issue $60,000 capital stock.

FEATHER RIVER POWER DEVELOPMENT.—The Western Pacific R. R. Co. is stated to have a force of 1100 men at work upon its electrical power development plant. A tunnel 3 miles long and 18½ x 20 ft. in the clear, cut through rock and lined with concrete, has been completed. It is stated that the plant when finished will have a capacity of 120,000 hp.

ANNUAL CONVENTION OF THE A. I. E. E.—The committee appointed to select a location for the next annual convention of the American Institute of Electrical Engineers has reported in favor of Atlantic City, N. J., with headquarters at the Hotel Traymore, and the Board of Directors has approved the selection. The convention will begin on June 29 and is expected to close on July 2.

PRATT ELECTRICAL STUDENTS ORGANIZE.—The students of the three classes which make up the industrial electrical course of Pratt Institute, Brooklyn, namely, the classes in electrical design, advanced electrical, and elementary electricity and mechanics, have formed an organization. A permanent chairman has been elected, and also a governing body consisting of three students from each class.

WAIPORI POWER PLANT.—In an article in our issues of Nov. 23-30, 1907, describing the Waipori power plant in New Zealand, the names of the following gentlemen, who assisted Mr. W. G. T. Goodman in carrying out the work, should have appeared: Mr. J. T. Wolf, who assisted in designing the electrical portion; Mr. E. E. Stark, who was at one time engineer of the Waipori Company and is now city electrical engineer in charge of the plant; Mr. E. W. Eckland, who supervised the converter-station work. Mr. F. R. Shepherd, who supervised the substation and low-tension transmission line, and Mr. J. Bowman, who supervised the erection of the building.

ROCHESTER INCREASED TELEPHONE RATES ILLEGAL.—The Appellate Division of the Supreme Court of the Fourth Department has declared illegal a recent increase of rates made by the Rochester Telephone Company. The decision was based upon a suit in which the old rate of $48 per year had been raised to $60, and held that municipal consent was required to raise rates by a condition attached to the telephone franchise. The contention of the telephone company was that in New York State the fixing of rates was not within the scope of a municipality. The court held that the telephone company is estopped from questioning the right of the city to regulate rates and from repudiating that part of its agreement with the city limiting telephone rates.

A. I. E. E. NOMINATIONS.—The Board of Directors of the American Institute of Electrical Engineers has selected the following nominees for the forthcoming annual election: President, Mr. L. A. Ferguson, Chicago. Vice-presidents, Messrs. C. C. Chesney, Pittsfield; Calvert Townley, New Haven; Bancroft Gherardi, New York. Managers, Messrs. D. B. Rushmore, Schenectady; H. E. Clifford, Boston; W. G. Carlton, New York; C. A. Stone, Schenectady. Treasurer, Mr. G. A. Hamilton, New York. Secretary, Mr. Ralph W. Pope, New York. The following were transferred from the grade of associate to full member: Mr. Henry James Shedlock Heather, Johannesburg, Transvaal; Mr. Howard Saunders Warren, New York, and Mr. Walter F. Wells, Brooklyn.

MARCONI ON WIRELESS.—In a lecture delivered last Friday before the Royal Institution in London, Marconi stated that communication across the Atlantic by his new plant has never been interrupted for more than a few hours at a time since the commencement of commercial work on Oct. 17. Mr. Marconi referred to the difficulty met with in transmitting during certain hours of the day. These periods, he said, come in the morning and evening, when daylight or darkness extends only part way across the Atlantic. He read a letter from the *New York Times,* in which it was stated that since October last that journal had received from its correspondents in England and on the Continent news dispatches totaling 68,404 words, promptly and efficiently transmitted by wireless.

NOBLE ELECTRIC IRON SMELTER.—The new experimental furnace at the Noble electric iron smelter, at Heroult, on Pitt River, near Redding, Cal., has been run continuously for several days, turning out 2400 lb. of pig iron every 24 hours. The new furnace is the design of Prof. Dorsey Lyon, of Stanford University, who superintended its construction and is directing its operation. The recent test run was very satisfactory, the furnace being tapped regularly every four hours. The Lyon furnace differs from the Heroult electric furnace in that it is operated by a single-phase current, the other being of the three-phase type. After a month's thorough test of the Lyon furnace a larger one will be constructed so to make a thorough test on a commercial basis of the process.

JAPANESE WATER POWERS.—Consul-General Henry B. Miller, of Yokohama, gives the following account of several of the numerous proposed Japanese water-power developments: In the case of one power site on the Tashiragawa the construction of a tunnel 3½ miles long would, it is stated, secure about 66,000 horse-power, and at another power site by means of about 10 miles of tunnel and a certain amount of open canal construction 150,000 horse-power could, it is reported, be secured. In the first instance there is a good reservoir site for storage, while in the second instance advantage would be taken of natural lakes. These sites, and others which have been surveyed, are in the Fujiyama district. Additional sources of power are near Nikko, where Lake Chuzenj would form the large reservoir, and where with four miles of tunneling a fall of 2,000 ft. could be secured; also in the Lake Inawashiro district, where the construction of four miles of tunneling would provide upward of 50,000 horse-power. An inspection of the principal sites and a study of the rainfall statistics over many years point to the probability of the initial plants giving, even during periods of drought, 300,000 horse-power. A favorable feature of the scheme is that the power sites provisionally selected are located within a comparatively short distance of Tokyo, where at the outset the bulk of the power would be taken. Between the capital and the sites referred to there is a minimum transmission distance of 80 miles and a maximum of 150 miles. It is estimated that the present requirements of Tokyo represent 48,000 horse-power, and that plants which will call for an additional 20,000 horse-power are in process of erection. These figures do not, however, include the electric road from Tokyo to Yokohama, or the elevated road which is being constructed by the government in Tokyo. One of the chief power sites is within 135 miles of the old capital, Kyoto, and Osaka, the Manchester of Japan, is only 160 miles distant. It is believed that with the growth of the interurban tramway systems in Japan there would be an immense field for cheap water power. Owing to the high price of coal the cost of steam power is high, and the utilization of water power should prove an important factor in the industrial development of Japan.

WESTINGHOUSE INTERESTS OPPOSE SALOONS.—According to a Pittsburg dispatch the Westinghouse interests have asked the court that no more liquor licenses be granted for the town of East Pittsburg, where the Westinghouse works are located.

KANSAS CITY RAILWAY & LIGHT.—The report of the Kansas City Railway & Light Company for the eight months ending Jan. 31, shows gross earnings of $4,175,058, and a surplus of $806,793, as against $789,797 for the same period of the previous year.

CONSERVATION OF NATURAL RESOURCES.—The April meeting of the American Society of Mechanical Engineers will be devoted to a consideration of the subject, "The Conservation of Natural Resources." Dr. H. S. Pritchett will deliver an address on "The Engineer as the Trustee of Our Natural Resources."

N. Y., N. H. & H. ELECTRIC SERVICE.—The electric service of the Hartford Railroad Company between New York City and Stamford, Conn., is being gradually extended. The Westinghouse single-phase electric locomotive now operates 12 through trains. It took an average of only three minutes to cut off the steam locomotives and attach the electric engines, and the running in all cases was smooth and on time.

ELECTROCHEMICAL COMMISSION.—Prof. E. Mascart, of France, has accepted the presidency of the Electrochemical Commission. This body, which has a central office in London, is the result of a recommendation of the St. Louis International Electrical Congress, and is supported by subscriptions from the various national electrical engineering associations of the world. It is understood that the presidency had been offered to Lord Kelvin just prior to his death.

CARNEGIE PENSIONS WAR TELEGRAPHERS.—Andrew Carnegie has placed on his pension rolls, at the rate of $144 per year, the names of such members of the Civil War military telegraph corps as a committee of the corps shall recommend. There were about 1200 of the telegraphers who served in the Civil War; less than 200 survive, and of these about 10 per cent are in needy circumstances. Congress had refused appeals to grant pensions to the survivors of the Civil War telegraph service.

A CORRECTION.—In the article entitled "Single-Phase Railway in Virginia" in the issue dated March 7, an error appears in the statement regarding the engineers in charge of the work. The consulting engineers for the work were Mr. S. W. Huff, formerly general manager of the Virginia Passenger & Power Company, and now president of the Coney Island & Brooklyn Railway Company, and Mr. George H. Whitfield, mechanical and electrical engineer of the Virginia Passenger & Power Company.

BREAK-DOWN CONSUMERS' HEARING.—Public Service Commissioner Maltbie, on March 10, held an informal conference with the consumers of break-down current in New York, to find out what their attitude is toward the $30 break-down rate fixed by the New York Edison Company. The consensus of opinion, as reported, was that the charge was prohibitive. The suggestion was made that the cost of insurance be kept distinct from the current charge, or at least that the basis of calculating the charge for break-down service be the maximum of current needed and used, rather than the kilowatt installation.

PIONEER TELEPHONY.—The recent death in Detroit of Mr. George W. Balch recalls the early days of telephony. In 1877 he organized the Telephone & Telegraph Construction Company, of which he became president, and the same year constructed several short telephone lines in Detroit, two being between the works and office of the Michigan Car Company and the Detroit water works, respectively. In 1878 he established what has been claimed to be the first telephone exchange in the world, which commenced with four or five lines, with 8 or 10 subscribers on each line. In 1879 the company constructed a line between Detroit and Port Huron.

BIDWELLS FOUND GUILTY.—Benson Bidwell and his son Charles F. Bidwell, promoters of the Bidwell "cold motor" scheme, have been found guilty of obtaining money by false pretences for operating a confidence game. The court instructed the jury that it could find the Bidwells guilty on only one count, whereby a verdict for operating a confidence game was gained, which is a penitentiary offence. During the trial it was shown that the Bidwells had received about $225,000 for stock sold. It was also shown that the Bidwell motor was kept cold by passing liquid carbonic acid gas through the field frame. Benson Bidwell is a brother of George and Austin Bidwell, who in 1872 victimized the Bank of England by means of forged bills to the amount of $1,000,000.

SOUTHWESTERN CONVENTION.—The Southwestern Electrical & Gas Association, which is to hold its convention at El Paso, Tex., May 7, 8 and 9, 1908, has selected the St. Regis Hotel as headquarters, and the management of the hotel has agreed to permit the use of two sample rooms in the basement for exhibition purposes, these sample rooms to be given free of charge for this purpose. If this space is not found sufficient for all who wish to make an exhibit, President H. T. Edgar announces that an effort will be made whereby all the exhibits can be shown together. Current for exhibits can be obtained from the El Paso Electric Railway Company, either single or two-phase, 60-cycle, 104 or 208 volts. Those wishing to exhibit should notify President H. T. Edgar, care of Northern Texas Traction Company, Fort Worth, Tex.

ELECTRICAL CURRENCY.—In these days of clearing-house certificates, scrip and other makeshifts for ready money, it is not surprising to find a new medium of exchange, which, for want of a better name, has been designated as "electrical currency." The proprietor of a certain large down-town café in New York not long ago was repeatedly puzzled to find that many of the 16-cp lamps in his restaurant had been unscrewed from their sockets and removed. As the lamps were supplied by the Edison Company and apparently were non-negotiable, the loss remained unexplained until at length it was found that a certain saloon down in the Bowery accepted the lamps in place of cash, at the rate of one lamp for each mug of beer. "As each lamp costs us in the neighborhood of 13 cents," said an officer of the Edison company, "it is quite evident that the drinks are on us."

TRANSATLANTIC CABLE JUBILEE.—Aug. 17 will be the fiftieth anniversary of sending the first cable message across the Atlantic Ocean. In August of 1857, the first attempt to lay a cable was made, but about 300 miles from the Irish coast a strain caused by a sudden dipping of the sea bottom caused the cable to part, and the attempt was for the time abandoned. A message of 90 words from Queen Victoria to President Buchanan, which took 67 minutes to transmit, was sent through the 1858 cable, but after a few following short messages it ceased to transmit signals. One of the electricians on the U. S. S. *Niagara*, which, together with the British war vessel, *Agamemnon*, laid this cable, always maintained that no message was ever sent, and that the message to Buchanan from Queen Victoria was "cooked up" for commercial purposes, his ground being that the cable had ceased to test out long before reaching the Newfoundland coast, and that on several occasions in paying it out accidents had occurred that had destroyed the insulation of the cable. In 1865 another unsuccessful attempt was made to lay an Atlantic cable, and the first operative cable was not laid until 1866.

Wireless Telegraph Plant at the United States Naval Academy.

BY LIEUT.-COM. W. H. G. BULLARD, U. S. N.

THE wireless station at the United States Naval Academy, Annapolis, Maryland, forms one of a chain of stations under government control extending on the Atlantic Coast from Frenchmen's Bay, Maine, to Galveston, Texas. Other stations in this chain are located at Guantanamo, Cuba; San Juan, Porto Rico; Culebra and Colon.

The station was established in June, 1904, not as a transmitting station for long distance, but rather as a relay station to forward such messages as it would be able to pick up from other stations or from vessels bound up or down the coast.

For this reason the power installed was small, the station set having only a rated capacity of 2.4 kilowatts. This power is obtained from a storage battery furnished by the Electric Storage Battery Company of Philadelphia, Pa., and consists of 40 cells, giving a normal voltage of 80 volts. When occasion demands, this battery is charged from power obtained from the main power station supplying the Naval Academy with light and heat.

The transmitting circuit contains the induction coil, condensers, inductance and spark gap of the well-known Slaby-Arco type. The direct current from the storage battery is led to the primary of the induction coil, and the make-and-break is effected by means of a mercury turbine interrupter, making 1600 revolutions per minute. With a line voltage of 80 volts, a maximum of about 25 amperes may be used in the primary windings. The condenser consists of seven leyden jars, connected in multiple with a total capacity of .014 microfarad. The inductance is a spiral conductor of No. 8 copper wire, consisting of 9.9 turns of a mean diameter of 17 in. The spark gap is a single break between zinc electrodes with a normal length of ¾ centimeter and a maximum length of 2⅛ centimeters.

The receiving device now used is of the De Forest type of electrolytic cell used in connection with the head telephones of the Schmidt-Wilckes make. This cell uses a Wollaston wire, glass jacketed, and of .006 in. diameter, as the anode, and a platinum wire as the cathode, in a solution of pure nitric acid. In connection with this cell is used a primary battery, with potentiometer. Associated with the detector in the receiving circuit is a capacity .005 microfarad with a variable inductance of two coils of copper wire wound with 500 turns on each coil.

The aerial is a loop of a total length of 1034 ft., consisting of four wires of phosphor bronze. It has a horizontal length of 100 ft. and a vertical length of 166 ft. The aerial is coupled direct to the transmitter inductance and has a natural wave length of 335 meters. The wave length ordinarily used is 318 meters for the lower hump and 420 for the upper. With the coupled circuit for 425 meters, the lower hump is 348 meters and the upper hump is 500 meters.

In the Department of Electrical Engineering at the Naval Academy and entirely distinct from the working station described above, is installed a 5-kw Stone wireless-telegraph plant, made by the Stone Telegraph & Telephone Company of Boston, Mass. This is used for the sole purpose of demonstration and for the instruction of midshipmen in their electrical course. The set is installed in a large room with all the working parts and wiring in the open so they may be easily got at and inspected.

The power is obtained from the Academy power plant, direct current of 110 volts being converted by means of a motor-generator into an alternating current of the same voltage. The current is controlled through a switchboard, containing the proper switches and rheostats to regulate the fields of both machines of the motor-generator; voltmeters, ammeters and reactance for the alternating current, and an automatic starting resistance for the motor. The motor-generator is started by the single operation of closing a double-pole switch on the operator's table.

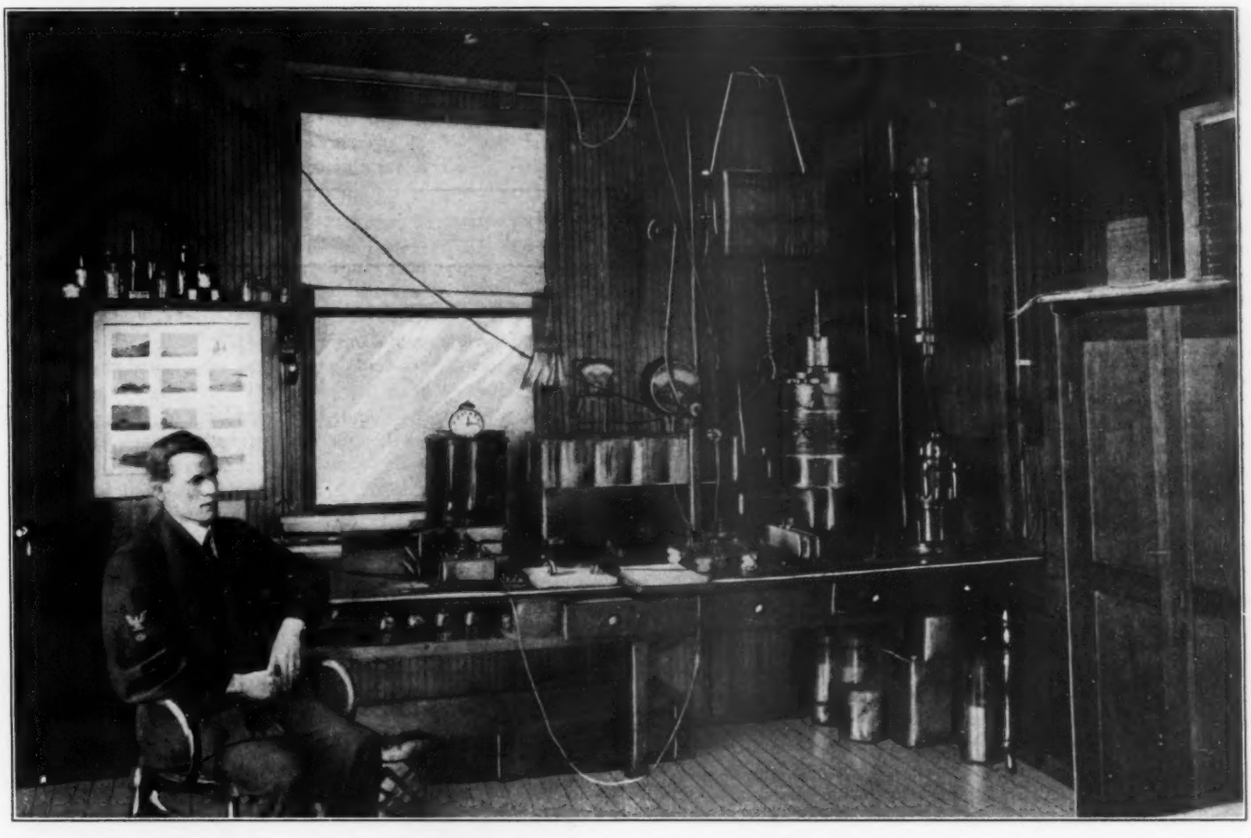


FIG. 1.—REGULAR WIRELESS STATION PLANT.

The distinguishing features of the Stone set are the multiple arrangement of the transmitting inductance, the series key for making signals, the spark gap and the "weeding-out" circuit of the receiver. The set is inductively coupled to the aerial and consists of four coils in parallel for the primary, connected inductively as an air transformer to four coils in parallel in the secondary. One terminal of each secondary coil is connected to the aerial through a loading coil and the other to ground. With the high frequency of the alternating current—

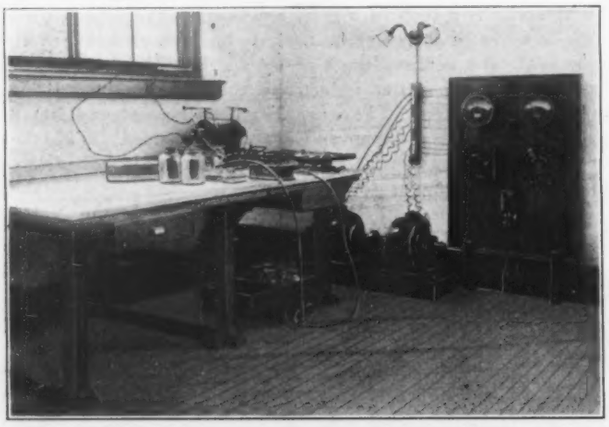


FIG. 2.—"HOME MADE" WIRELESS SET.

120 cycles per second—and the large inductance, this is necessary to produce the short wave-length desired.

In this system, the circuit is made and broken to produce the proper signals on the high-potential side of the induction coil. This obviates breaking the heavy current of the primary and the consequent arcing and burning of the key contacts. The high-potential side is made and broken in both leads of the mains by a line of contacts in series. These contacts are actuated by small electromagnets, wired in series with the low-potential current of 110 volts. Inserted in this circuit is a resistance to reduce the current through the electromagnets to about one ampere. The key that operates the series keys is on the operator's table, and is a simple telegraph key whose terminals are connected to a small condenser. Making and breaking this auxiliary current has the effect of making and breaking the line on the high-potential side of the induction coil.

The spark gap consists of a series of parallel brass rods through which the spark occurs, and it can be regulated by a rod on one terminal which slides over them, cutting out more or less of the rods. To remove the metallic vapor formed at the spark, a strong blast of air is blown over it from an auxiliary blower.

The receiving circuit contains the usual inductance and capacities, and normally consists of three circuits, all inductively connected. The third circuit contains the electrolytic detector and head telephones. The middle circuit is termed the "weeding-out" circuit and is used when sharp tuning is necessary to cut out interference. All the capacities are of the variable sliding type, and the primary inductance of the sliding bare wire type. Arrangements are made for varying the mutual induction of all the circuits by moving one inductance in relation to the other in each circuit.

The condenser is of the glass-plate tin-foil type, made up in four sections, one being connected to each of the four primary circuits of the oscillating transformer. Its dielectric is castor oil, which is used to reduce the violet discharge at the edges of the tin foil on the glass plates.

In connection with the instruction of midshipmen, there is installed in the Department of Electrical Engineering another small wireless telegraphy plant of no particular make or system, but containing all the elements required for the proper sending and receiving of signals. The power is transformed from the Academy plant voltage to a lower voltage of continuous current by a small rotary transformer. This direct current is used with an ordinary induction coil with a hammer make-and-break; a battery of leyden jars forms the condenser and a helix of copper wire the inductance.

For receiving, a small incandescent lamp is used as a detector, the filament being removed and the interior filled with nitric acid introduced to cover the platinum points of the leading-in wires. This is used in connection with an ordinary telephone receiver. It may not be amiss to state that all of the apparatus has been made from the odds and ends to be found in a physical laboratory, but it well illustrates the principles, and the sending and receiving are both very efficient. This home-made plant is entirely at the disposal of the midshipmen under instruction, who can perform any experiments they please, make such connections as they fancy, and get such results as they may.

All midshipmen are required to take the same course in all branches of electricity, and wireless work forms a small but very important part of the course. At the outset of the course in wireless work, a general lecture is given to the whole class, in which are explained by figures and sketches the general principles of the science, what is expected to be done and how it is to be done. This first lecture takes up the elementary sending and receiving circuits, the operation of the transmitter to produce the electromagnetic waves and that of the receiver to detect and record their presence. This lecture is followed later, when the actual apparatus is understood, by one on the adjustments required, on the tuning of the different circuits, with a description and exhibition of the different forms of wave meters.

After the first lecture, the midshipmen are divided into squads in charge of an officer and sent to the "home-made" plant spoken of above, where the lecture is supplemented by an inspection of the apparatus and the actual phenomena of transmitting and receiving are observed. This tends to awaken an interest, questions thick and fast are the result, and the session rapidly develops into another lecture. After the general principles are well grasped and the functions of each separate piece of apparatus is well understood, they are taken by squads to the other two plants in turn. At the Department plant they can observe the working of each individual part and trace each connection; and at the working plant they can witness official

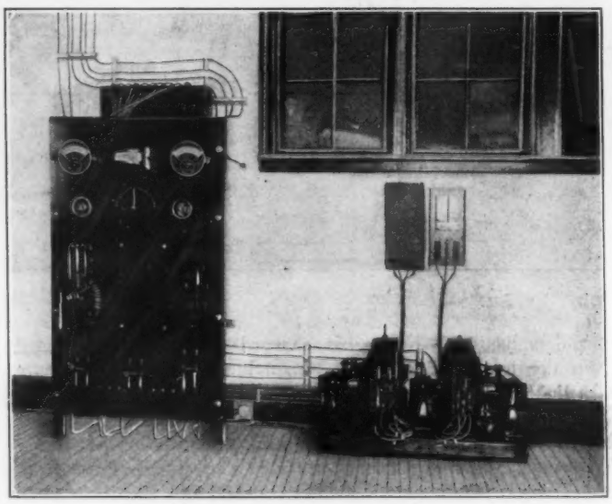


FIG. 3.—AUTOMATIC SWITCHBOARD AND MOTOR-GENERATOR.

messages being sent and received by expert operators. At each place they are under the direct supervision of an officer instructor, who follows out all the details, explains all parts, and requires all to record in note-books what they have seen or heard or done. These note-books are written up in smooth style after the instruction period is over, and are then submitted for inspection and correction. The students are required to make diagrams of all the connections, indicate all apparatus,

state functions of each individual piece, and state what occurs in each portion of the circuit from the time current is turned on until it is broken.

After a lecture on the tuning of the various circuits, which is given to the whole class at a time, they are again taken by squads and shown by expert operators how to find the natural vibration period of each circuit; how to tune any circuit to a given wave length; how to couple the circuits, and how to find the resultant wave length. They are each required to obtain data by which the form of the wave sent out may be plotted and are required to plot different wave forms for different conditions.

In all, each midshipman receives eight hours' practical instruction with the wireless plant, in addition to the time devoted to lectures and to section room work, where each is required to recite on lessons previously assigned. This last

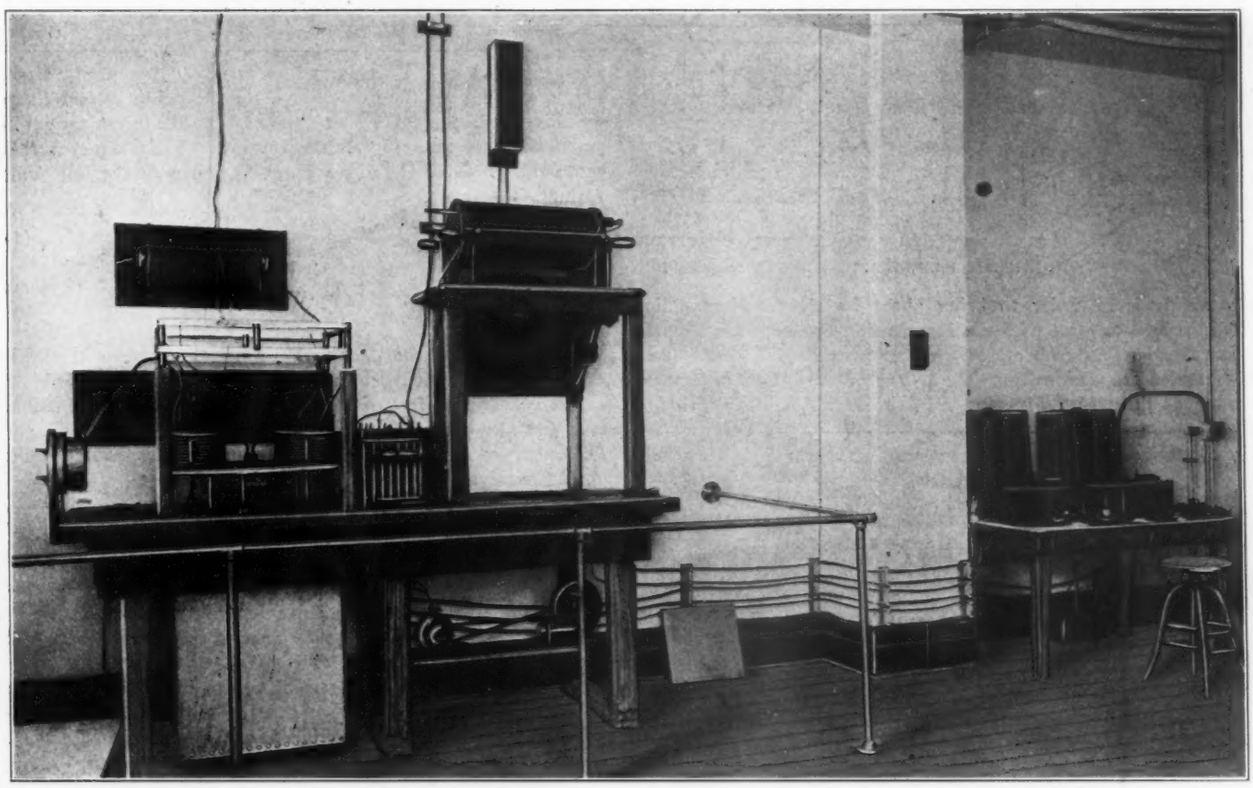


FIG. 4.—STONE TRANSMITTING APPARATUS AT LEFT. TWO RECEIVERS AT RIGHT.

requires about five hours of time, each recitation period being one hour. There is no attempt to make expert operators out of the midshipmen students, but rather to make them familiar with the general principles involved, with as much actual apparatus as possible, and to make them capable of taking charge of a wireless plant on ship board, and to make all adjustments and be prepared for any emergencies or accidents that may occur.

A new wireless plant of 20-kw capacity has been contracted for by the Bureau of Equipment, Navy Department, to be installed at the Naval Academy, which will make one more plant that can be utilized for instruction and demonstration purposes, and an installation of wireless telephones will shortly be made to aid in the general course of instruction.

Water Power.

The March number of the *General Electric Review* contains a paper by R. E. Horton presenting a résumé of the advantages that may result from the substitution of central hydro-electric power stations with short transmission lines to the mills, in place of the present systems of power development and distribution at many existing water-power centers.

Influence of the Height of Suspension Upon Uniform Illumination.

By Alfred A. Wohlauer.

In an article which appeared in the issue of Electrical World for Dec. 21, 1907, the present writer attempted to deduce methods that lead to uniform illumination of large horizontal planes by means of a multitude of lamps properly distributed over the whole area.

This problem is of importance at the present time where new kinds of incandescent lamps, as well as the small-size arc lamps, make such a method of illumination for large rooms advisable on account of cheapness and the agreeable influence upon the eyes. Moreover, the same rules hold true also for outdoor lighting where still larger areas and powerful arc lamps are concerned. For this and for other reasons it seems to the writer worth while to dwell somewhat exhaustively on the influence which the height of suspension of the lamps exercises upon uniform illumination.

It has been pointed out by E. W. Weinbeer that for every type of lamp or for the corresponding polar-curve a certain height of suspension can be calculated as the minimum allowable for uniform illumination. He stated that the lamp units can be raised above the minimum height without impairing the intensity of illumination or the uniformity of light distribution. However, a suspension lower than the minimum will result in non-uniform illumination if the distances between the lamps and the shape of the polar-curve remain the same.

The facts stated by Weinbeer are applicable to the theoretical curves of the previous article, which represent the case of minimum height of suspension, corresponding to a certain value of K. ($K = \frac{D}{H}$, where D = distance between two lamps, and H = the height of suspension.) A suspension lower than H without a change of the other values, as K, D, polar-curves, etc., results in non-uniform illumination, as illustrated by Figs. 1 and 2. In Fig. 1, where $H = 4$, $D = 4$, as in Fig. 3 of the previous article, the illumination I_{ab} is uniform, while in

Fig. 2, where the suspension is 1 ft. lower, the variable illumination curve I_{ab} will be obtained. This is due to the fact that the illumination curve of a single lamp passes through zero at the points S and T (of Fig. 2), where the illumination of the other lamp has not yet reached its maximum value equal to the desired uniform illumination.

On the other hand, an increase of the height of suspension above H changes neither the intensity nor the uniformity of illumination, provided again that the other factors, such as distance, polar-curves, etc., remain unchanged.

This may be considered as an important law of illuminating engineering, and it is, therefore, pertinent to thoroughly in-

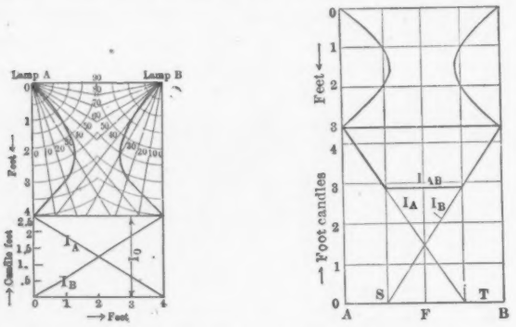


FIG. 1.—UNIFORM ILLUMINATION, MINIMUM HEIGHT OF SUSPENSION. FIG. B.—NON-UNIFORM ILLUMINATION, LOWER SUSPENSION.

vestigate it in order to bring about its clear understanding

It is well to start with the illumination produced by a single lamp and to remember that the illumination of a single lamp decreases proportionally to the square of the height of suspension, as illustrated by curve RST of Fig. 4, and by Table I.

TABLE I.—INTENSITIES OF HORIZONTAL ILLUMINATION FROM ONE LAMP.

Height, feet.	Illumination below lamps.
2	10
3	4.44
4	2.5
5	1.6
6	1.11
7	.82
8	.625
9	.494
10	.4

The uniformity becomes better with increased height of suspension, or, in other words, the relation between maximum and minimum illumination decreases toward unity. (Fig. 3.)

If (not more than) two lamps are employed, and if the polar-curves have a shape as suggested in the article mentioned above, the following conditions will prevail. The line between the points A and B (the foot of the perpendiculars from the lamp centers) will be uniformly illuminated if the height of

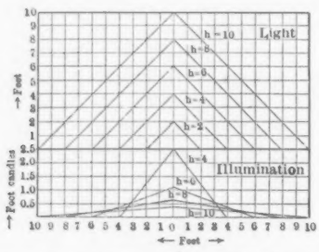


FIG. 3.—INFLUENCE OF HEIGHT OF SUSPENSION UPON INTENSITY AND UNIFORMITY OF ILLUMINATION FROM ONE LAMP.

suspension is such that the illumination curve of one lamp passes through zero just where the maximum illumination of the next lamp sets in.

If the height of suspension is smaller, the illumination will not be uniform, as illustrated in Fig. 2; the illumination of the point F, which is just in the center of the line AB, will vary according to curve VS of Fig. 4, while the illumination in the points just below the lamps is the same as if one lamp alone were present, which is illustrated by curve RS, in Fig. 4. S is the minimum height of suspension (see Fig. 4).

If the lamp is suspended higher than the limit for uniform illumination, the light distribution will remain uniform along the line AB, but it will decrease with the height of suspension, although not proportional to the square of the height of sus-

TABLE II.—INTENSITIES OF HORIZONTAL ILLUMINATION FROM TWO LAMPS.

Height, feet.	Foot-candle illumination. Below lamp.	Between lamps.
2	10	0
2.25	7.8	1.66
2.5	6.4	2.56
3	4.4	2.96
3.5	3.25	2.8
4	2.5	2.5
5	1.92	1.92
6.	1.48	1.48
7	1.16	1.16
8	.94	.94
9	.77	.77
10	.64	.64

pension. (Table II.) This is illustrated by the curve SU of Fig. 4, which gives the illumination for the points A and B, as well as for the point F, and shows that the illumination is practically the same for all three points. The values of this curve and of Table II are calculated by means of the following formulas:

$$I_A = \frac{L}{h^2} + \frac{L}{h^2}\left(1 - \frac{H}{h}\right) \qquad (1)$$

$$I_F = \frac{L}{h^2}\left(2 - \frac{H}{h}\right) \qquad (2)$$

in which

L = candle-power illumination vertically downward.
h = variable distance in feet from lamp to surface.
H = height in feet of suspension for uniform illumination.
I = foot-candle illumination.

(Index A or F in the tables refer to the corresponding point on the surface.)

In equation (1) the quantity $\frac{L}{h^2}\left(1 - \frac{H}{h}\right)$ reduces to zero for $h < H$.

If $h > H$, equations (1) and (2) are identical, which proves that the illumination I_{ab} is uniform for h larger than H.

The illumination of the space outside of the line AB will not be discussed in this article.

If a multitude of lamps is employed to illuminate a certain area, the illumination will be practically uniform if the conditions comply with the laws deduced in above-mentioned article.

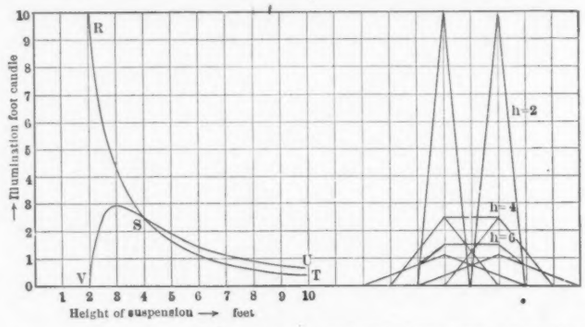


FIG. 4.—INFLUENCE OF HEIGHT OF SUSPENSION UPON ILLUMINATION DUE TO TWO LAMPS.

A suspension of the lamps lower than corresponding to the above laws results in non-uniform illumination, as stated above. There is no difference if one, two or more lamps are employed.

For higher suspension than "minimum height of suspension," equations can be deduced from which the values of illumination for different heights of suspension can be calculated. These equations are extremely long and are rather complex for the general case, but they will be considerably reduced and simplified if the relation $\frac{h}{H}$ does not exceed practical values.

From such equations, the values of illumination for different

points have been calculated, also graphical determinations have been employed, and it has been found that the number of lamps which participate in the illumination of a certain point increases with the height of suspension, and while the illumination due to a single lamp decreases proportionally to the square of the height of suspension, the total illumination remains the same, however much the lamps are raised above the surface.

Equations (3) and (4) have been used to calculate the illumination for the point A, just below the lamp and for E, the point of intersection of the diagonals. These equations consist of a number of members indicating the number of lamps which participate in the illumination of the point in question. For instance, in equation (3), the first member $\frac{L}{h^2}$ gives the illumination produced by the lamp just above the point A. The next member $\frac{L}{h^2}\left(1.1 - 1.2\,\frac{H}{h}\right)$ represents the illumination from the lamps nearest to lamp A, the next following member, the illumination from the next set of lamps, etc. The number of these members, as said, increases with the height of suspension, while a member is zero as long as the expression in parentheses remains zero or less than that value.

$$I_A = \frac{L_v}{h^2} + \frac{4L_v}{h^2}\left(1.1 - 1.2\,\frac{H_1}{h}\right) + \frac{4L_v}{h^2}\left(1.1 - 1.7\,\frac{H}{h}\right) + \frac{4L_v}{h^2}\left(1.1 - 2.4\,\frac{H}{h}\right) + \frac{4L_v}{h^2}\left(1.1 - 3.4\,\frac{H}{h}\right) + \frac{8L_v}{h^2}\left(1.1 - 2.7\,\frac{H}{h}\right) + \text{etc.} \qquad (3)$$

$$I_E = \frac{4L_v}{h^2}\left(1.1 - .85\,\frac{H}{h}\right) + \frac{4L_v}{h^2}\left(1.1 - 2.55\,\frac{H}{h}\right) + \frac{8L_v}{h^2}\left(1.1 - 1.9\,\frac{H}{h}\right) + \frac{8L_v}{h^2}\left(1.1 - 3.06\,\frac{H}{h}\right) + \frac{8L_v}{h^2}\left(1.1 - 3.34\,\frac{H}{h}\right) + \text{etc.} \qquad (4)$$

The equations (3) and (4) are based on a distribution of light such as is represented by Fig. 5, which is taken from the article mentioned above; as shown in Figs. 6 and 7 of that article, this distribution provides practically uniform illumination over the whole area at the minimum height of suspension.

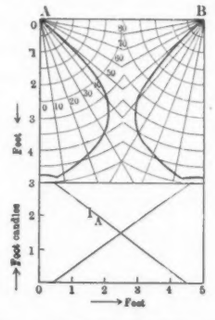


FIG. 5.—POLAR CURVES FOR UNIFORM ILLUMINATION.

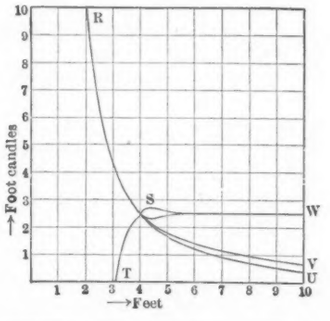


FIG. 6.—ILLUMINATION BY A MULTITUDE OF LAMPS.

The illumination under a certain lamp, which comes from this lamp, is uniform for an area within a circle, the radius of which is .085 times the distance between two lamps, and beyond this area the illumination from this lamp decreases regularly to zero at a point where the maximum illumination of the next lamp begins.

As an example, the equations have been used for the calculation of the intensities of illumination at different heights of suspension introducing into the equations as constants the values, $D = 4$ ft., $H = 4$ ft., and $L_v = 40$ candles.

The results of the calculations are represented in Fig. 6 and Table III. S illustrates again the conditions for minimum height of suspension; the curves RS and ST refer to lower suspension, RS giving the illumination just below the lamps, TS the illumination at the point of intersection of the diagonals. The line SW, however, shows the illumination for suspensions higher than the minimum and proves that the illumination remains practically constant and uniform if the lamps are raised above the minimum height of suspension.

TABLE III.—INTENSITIES OF ILLUMINATION FROM A MULTITUDE OF LAMPS.

Height, feet.	Foot-candle illumination. Below lamps.	At intersection of diagonals.
2	10	0
2.25	7.8	0
2.5	6.4	0
3	4.4	0
3.5	3.25	1.75
4	2.5	2.5
4.5	2.35	2.65
5	2.45	2.55
6	2.48	2.53
7	2.49	2.51
8	2.5	2.5
9	2.5	2.5
10	2.5	2.5

This law might be derived more systematically by an extensive use of mathematics. It is believed, however, that the above method is rather desirable, as the facts are brought out in a more comprehensive form.

From the above law it is permissible to draw the following conclusion, which is also of importance for illuminating engineering: It is not necessary to make the distance D between two lamps less than the minimum height of suspension H; in other words, the factor K need not be smaller than 1.

For example, if the plane should be illuminated with an intensity of three foot-candles and, for instance, lamps having a candle-power of 75 candles vertically downward are available, the minimum height of suspension would be $H = \sqrt{\frac{L_v}{I}} = \sqrt{\frac{75}{3}} = 5$, and, therefore, the distance between the lamps also $= 5$ for polar curves of $K = 1$ and larger than that for greater values of K. If it is necessary for reasons of practicability, æsthetics, etc., to suspend the lamps higher than 5 ft., one may do so without impairing the intensity of illumination or the uniformity of light distribution, but it is not necessary to change the polar-curve into one of which K is less than 1.

It is even better to suspend the lamps above their minimum height of suspension since, as shown in the above discussion, the uniformity of illumination is improved by increasing the height of suspension.

Commutators of Traction Motors.

The Elektrotechnische Zeitschrift for Feb. 20, referring to the report of the Municipal tramways of Frankfort, describes some troubles experienced with commutators. The copper segments of the commutator are insulated from each other by mica insulation and it was found in one case after a large number of motors had been supplied that the commutators were subjected to considerable wear and tear, due to excessive sparking at the brushes. It was found that the mica insulation was projecting slightly above the copper segments so that the contact between the carbon brush and copper segments was not as good as necessary. The mica insulation was cut down below the copper by about 1.5 mm. This proved very successful. It was first feared that carbon powder might collect on the mica and thus produce a connection between two adjacent segments and a special brush for removing this powder was used, but experience has shown that this is unnecessary. Any powder which might collect is at once driven off by centrifugal force combined with the air draft. A special machine has been constructed for deepening the mica insulation.

The Value of Electrification as a Steam-Railroad Improvement.

By Clarence P. Fowler.

WHILE the wholesale electrification of trunk lines of steam roads may ultimately become a fact, yet such complete and radical changes in equipment and methods of operation will doubtless have their origin in the partial adoption of electricity as a motive-power for handling local passenger traffic of the suburban or interurban type, gradual extensions following until electrified sections merge into one. The electrification of long-distance lines is coming every day more within the range of commercial possibility, largely as a result of the introduction of the simple and economical single-phase railway system and partly due to better-distributed traffic, which was of a more concentrated nature in years past.

Considerable discussion has taken place during the past year on the technical aspect of electrification problems, such as, for example, detail studies of designs of equipments, the best system to employ, etc. The purpose of the present article will be to briefly deal with the commercial features of steam-railroad electrification as relating to local passenger traffic, pointing out the large inroads that the electric interurban railroads have made upon the local passenger traffic of parallel steam lines, by reference to authentic and up-to-date statistics, believing that results of actual experiences form the basis for the strongest arguments pointing to the financial gains which may be expected from the adoption of electricity as a motive-power by the steam railroads.

The financial phase of the problem relating to the net return on the investment required to electrify naturally forms one of the most important elements from the standpoint of steam-railroad management, and it is this feature which must ultimately be the final argument controlling a decision for or against improvements of this character.

Interurban electric railways in the United States now have approximately 20,000 miles of track in successful operation—surely a marvelous growth since the time of their inception, only some 10 years ago. The growth and success of these roads are not peculiar to any particular community, as they will be found in successful operation in the states of Illinois, Ohio, Indiana, Michigan, New York, New Jersey, Pennsylvania and New England, as well as some quite extensive and up-to-date electric interurbans in the Pacific Coast States, where the famous Inland Empire Single-Phase Railway System is in operation with its 225 miles of track located in Washington and Idaho. This road is admitted by steam-railroad men as quite the equal of any steam road in the country, not only doing an extensive passenger business, but also handling a large amount of freight in trains and exchanging it with steam roads —notably with the Great Northern Railway system.

Perhaps the chief distinguishing feature in methods of train operation with electric traction, as compared with steam, is found in the train-lengths and frequency of service offered by the two respective systems, the former being commercially capable of operating frequent short trains or even single cars, as compared with relatively long trains at infrequent intervals by steam traction.

The reasons for this are purely economic in character, as may be easily seen from a consideration of the operative costs of the moving unit for the two systems in question. Having found the cost of operating a steam passenger train a mile, it will be noted that it is practically constant and independent of the train-length. The cost of operating a passenger train a mile for six representative steam roads reporting to one of the Eastern state railroad commissions for 1906 is as follows:

TABLE I.

Road.	Total expense per passenger train-mile.
A	$1.15
B	0.84
C	0.77
D	0.99
E	1.18
F	1.43
Average	$1.06

The cost of operation per car mile for six interurban railway systems, including all expenses of operation, taxes and fixed charges, as reported to three of the state railroad commissions for the year 1906, is:

TABLE II.

Road.	Cost.
A	$0.17
B	0.22
C	0.215
D	0.18
E	0.21
F	0.23
Average	$0.204

From the above it is apparent that the low cost per mile of the moving unit with the electric service, and, therefore, low unit load required to pay expenses, is the underlying principle which places steam locomotive-hauled trains at a disadvantage. If it be assumed that the average rate received per passenger per mile is 1.5 cents, it will be seen from the average cost of operating an electric and steam train, as given in Tables I and II, that an average occupancy of about 14 passengers per mile will pay expenses with the electric service, whereas steam-train service would require an average of about 70 passengers per mile. Putting it another way, the electric system can render five times as frequent service as steam and meet all expenses of operation.

The superior service thus inherently possible with electric traction has eminently adapted it to suburban and interurban passenger traffic, and the general increase in this class of traffic has been one of the most notable features of the electric service, as exemplified in the modern interurban road. Experience has demonstrated that the amount of traffic in most cases has increased commensurately with the transportation facilities offered.

The normal location of the interurban road is parallel to the steam road, and, being so located, becomes a competitor with the latter for local passenger traffic. As such, it not only absorbs most of the existing traffic of this character from its steam rival, but in a short time creates new traffic many times greater than that which originally existed. As bearing on the ability of the interurban road to take most, if not all, of the local passenger business of parallel steam lines, the Department of Commerce and Labor of the United States has published statistics showing that 14 different interurban roads operating in seven different states, from New York to Iowa, and paralleling steam roads, did from 90 to 100 per cent of the local passenger business in the competing territory. By reference also to statistics published by the Interstate Commerce Commission it will be noted that the average length of journey per passenger on steam trains in the United States prior to the introduction of interurban roads, from 1892 to 1897, increased from 23.82 miles to 25.04 miles, an increase of only 5 per cent. In 1897 the inauguration of the alternating-current system for electric railways made the longer distance interurban road commercially feasible, and during the five years 1897 to 1902 the Interstate Commerce Commission records the increase of the average length of journey per passenger on steam trains in the United States from 25.04 miles to 30.3 miles, an increase of about 21 per cent, which no doubt was partly a result of the curtailment of local passenger traffic of steam roads due to interurban electric-railway competition. As late as October, 1907, the *Railroad Gazette* published some very interesting data on the electric railway as a competitor of the steam road. The *Gazette* tabulated official reports from some 111 interurban roads in 25 different states, thus giving representative returns from practically all quarters of the United States. The aggregate mileage of the roads so reporting was 3361, and a great part of the roads listed did, as is usual, from 90 per cent to 100 per cent of the local passenger business.

Two concrete examples are given below which illustrate, quite pointedly, the effect of interurban railway competition upon the local passenger traffic of parallel steam roads. These instances are taken from one of the Central Western states where perhaps the interurban road has reached its highest state of development. Numerous examples of this character could be

given, but as these here noted are typical, they will suffice to bring out clearly the point in question.

CASE I.

Distance between extreme points of competition	29 miles
Local passenger earnings of steam road, per mile, 1895	$2,750
Local passenger earnings of steam road, per mile, 1906	570
Local passenger earnings of electric competitor, per mile, 1906	4,950
Total passenger earnings of steam and electric, per mile, 1906	$5,520

Percentage of total local passenger business done by electric road, 90 per cent.

The business done by the interurban road represented a loss to steam road made up as follows:

Loss of original passenger business $2,750—570 per mile	$2,180
Loss of newly created passenger business which steam road could probably induce if electrified, $5,520—2,750	2,770
Total loss of passenger business to steam road	$4,950
From U. S. mail, freight and express, the electric earned	566
Grand total loss to steam road	$5,516

CASE II.

Distance between extreme points of competition	26 miles
Local passenger earnings of steam road, per mile, 1895	$1,020
Local passenger earnings of steam road, per mile, 1906	150
Local passenger earnings of electric competitor, per mile, 1906	5,150
Total passenger earnings of steam and electric, per mile, 1906	$5,300

Percentages of total local passenger business done by electric road = 98 per cent.

The business done by the interurban road represents a loss to the steam road as follows:

	Per mile.
Loss of original passenger business $1,020 — 150 =	$ 870
Loss of newly created passenger business which steam road could probably induce if electrified $5,300 — 1,020 =	4,280
Total loss of passenger business to steam road	$5,150
From U. S. mail, freight and express, the electric earned	352
Grand total loss to steam road	$5,502

Some idea of the relative importance of local or short-haul passenger business to steam roads may be gained when it is remembered that the average journey per passenger on all steam railroads in the United States in 1905 was reported by the Interstate Commerce Commission to be only 32.21 miles.

The great value of local passenger traffic to steam roads is further demonstrated by the accompanying table which gives the relative amount of passenger earnings due to through and local passenger traffic for six of the principal steam railroad systems of the United States:

TABLE III.

Road.	Total passenger earnings, per cent. Through.	Local.
1	15	85
2	12	88
3	16	84
4	25	75
5	12	88
6	19	81
Average	16.5	83.5

The figures in Table III illustrate the large proportion of the total passenger earnings on steam roads that result from the local or short-haul passenger, and show conclusively that steam-railroad systems cannot well afford to lose this class of traffic. This is, however, as may be seen from statistics already given, the very business which is at present most severely attacked by the parallel interurban road.

As a result of a carefully conducted canvass, the *Street Railway Journal* obtained official reports, as late as October, 1907, of more than 100 new interurban electric-railway projects, aggregating some 5000 miles of track located in 35 states of the Union. These reports furnish detailed statements as to the name of the railway company, names of officers and proposed route. The writer has gone over the various routes covered by these enterprises with a view to ascertaining what percentage of these new railway ventures are projected in the territory now occupied by steam roads. The results of this study are as follows:

(1) Proposed electric interurban railways which parallel steam roads, 83.

(2) Steam railroad systems paralleled, 48.

(3) Proportion of proposed 5000 miles of interurban electric railways which parallel steam roads, 4600 miles.

(4) Percentage of total mileage paralleling steam roads, 92 per cent.

The mileage given above as paralleling steam roads is doubtless only a small portion of that which will be put in operation in the whole of the United States at no remote date, but it serves as some criterion of what may be expected by the steam roads in this direction. It also demonstrates ample proof of the belief of the promoters that these roads may be counted on to give a good account of themselves by absorbing, as usual, most or all of the local passenger traffic of the competing steam road and by stimulating the "riding habit," which is productive of much new traffic in virtue of the superior service rendered by the interurban road.

By the statistics thus far given it has been shown that:

(1) It is commercially impracticable to render as frequent service with steam locomotive-hauled trains as with electric traction.

(2) When steam and electric interurban roads compete for local passenger business the latter, in virtue of the service they are so well qualified to render, take away practically all the local business from the former, in addition to a large amount of new traffic created.

(3) By far the greater proportion of passenger revenue on steam roads is obtained from local passenger traffic, hence the advisability of conserving this source of income.

(4) The great success of interurban roads as competitors of steam roads has given rise to a continued tendency to project new electric railway enterprises in the territory occupied by steam roads as evidenced by the 4600 miles of the proposed 5000 miles of interurban railways so located.

From what has been said it is apparent that if the steam roads persist in the present methods of handling local passenger traffic, they must suffer the loss that will inevitably result from future parallel interurban competition, so that in considering the electrification of a section of a steam road, not at present paralleled by an electric competitor, it is not sufficient to compare existing local passenger earnings under steam operation with future local passenger earnings under electrical operation, but greatly reduced local passenger earnings under steam operation (due to ultimate competition with a parallel interurban road) should be compared with future earnings if the section under consideration be electrified.

The well-managed interurban road in its present advanced state of development is admitted to approach closely to steam railroad practice, differing only in motive-power, in the operation of single cars or short trains at frequent intervals, and having free access to cities where steam locomotive-propelled trains would, of course, not be tolerated.

These questions naturally arise: What move are the steam roads going to make? Do they propose to let their local passenger business dwindle to naught when they can, by the use of the same motive-power which their electric competitors find so efficient, retain their present and create much new short-haul passenger business?

The parallel interurban road becomes an impossibility by the prior electrification of the steam road unless the available traffic be of considerable proportions or unless the steam road is very unfavorably located to attract it. If the steam road has been paralleled by an interurban road previous to electrification, the former can doubtless recover much of its lost business. This condition of affairs already exists on a steam road in England, where competition from a parallel tramway is keen.

In the partial electrification of steam-railroad lines for handling passenger traffic of the suburban or interurban class, the experience gained from the interurban road must to some extent be the guide.

Table IV is a statement of gross earnings, operating expenses, taxes and fixed charges of a dozen representative interurban roads in the Central Western States. These interurban roads are all competitors with steam roads for local passenger traffic and are selected as having very little city mileage, most all of it being interurban.

It is seen from this table that the average gross earnings from all sources per mile of track of the roads listed is $4,750 and the average ratio of operating expenses, taxes and fixed charges to gross earnings is 87 per cent. It is fully recognized that the extent of population of the territory traversed, habits

of the people, earning power of the population, effects of large urban centers of inducing traffic toward them, etc., have a bearing upon the earning power of the interurban road, so that gross earnings of $4,750 per mile are probably somewhat high for the average well-managed road of this class in the United States; therefore, it can be conservatively assumed that the average of the proposed roads composing the 4600 miles parallel to steam roads earn, say, 75 per cent of the above amount, or $3,500 per mile.

TABLE IV.
Per mile of track.

Road.	Gross earnings, 1906.	Operating expenses, including taxes and fixed charges.	Net Income.	Per cent of operating expenses, taxes and fixed charges to gross earnings.
1	$2,800	$2,300	$500	82
2	6,600	6,000	600	91
3	8,300	7,300	1,000	88
4	5,400	4,600	800	84.5
5	4,850	4,100	750	85
6	6,000	5,100	900	85
7	4,900	4,050	850	83
8	3,150	2,650	500	84.5
9	3,050	2,775	275	91
10	2,250	1,820	430	81
11	3,650	3,450	200	95
12	5,750	5,350	400	93
Average	$4,750	$4,124	$600	87

From the previous cases cited it may be seen that the business done by an interurban road means a loss to the steam road made up of loss of original business, loss of new business created, and, finally, loss of freight, express and United States mail carried by the former. It will be interesting to see what will be the probable distribution of this loss to the average steam road composing the 4600 miles parallel to the proposed interurban railways previously mentioned. If the freight, mail and express business is properly pushed, this end of the business would probably average $500 per mile gross, leaving $3,000 per mile for gross passenger earnings, and this will represent probably 90 per cent of the total passenger business in the competing territory or the total passenger business would probably aggregate $\frac{\$3000}{.9} = \$3{,}333$ per mile. As the service given by an electric road usually increases the total business from two to five times, as has been noted, the original earnings of the average steam road would approximate, say $\frac{\$3333}{3} = \$1{,}111$ per mile.

The total business that will, therefore, probably be done by the proposed average interurban road represents an estimated loss made up as follows:

Loss of original passenger business	$1,111 − $333 = $ 778
Loss of newly created passenger business	$3,333 − $1,111 = 2,222
Loss of freight, mail and express business	500
Total estimated loss of average steam road	$3,500

On this basis the total estimated loss of gross business to 4600 miles of competing steam roads would be $4600 \times \$3{,}500 = \$16{,}100{,}000.00$.

Since the average percentage of operating expenses, taxes and fixed charges for the 12 interurban roads given in Table IV average about 87 per cent, and if in order to be conservative it be assumed that the average interurban road of the 4600 miles proposed averages about 90 per cent, this will give a total estimated loss of profit to the 4600 miles of competing steam roads of $4600 \times \$350 = \$1{,}610{,}000.00$.

Now, it should not be forgotten that the ratio of operating expenses, taxes and fixed charges to gross earnings of 90 per cent is obtained by roads now using the system employing high-tension transmission, feeding the cars from a 600-volt trolley and feeders supplied from rotary-converter stations, which system is relatively high in capital cost and cost of operation, as will be shown, and the competition caused by electric interurban roads will beyond all question become more and more acute as the introduction of the single-phase system proceeds.

A brief review of the chief commercial advantages which recommend the use of the single-phase system rather than the standard 600-volt direct-current system will show:

(1) Simplicity in system as a whole.

(2) High trolley voltage, permitting:

(a) Reduction in cost of feeder copper.

(b) Reduction in number of sub-stations.

(3) Elimination of rotating machinery, requiring attendance, from substations.

For the purpose of demonstrating the decrease in operating expenses that will result through the use of the 11,000-volt single-phase system instead of the standard 600-volt direct-current alternating-current system, the following comparison is made between the capital and operative costs of two single-track interurban roads 100 miles long, each equipped with these systems:

Weight of direct-current car and load, 40 tons.

Weight of single-phase car and load, 42 tons.

Schedule speed, 25 miles per hour.

Number of stops are such that average energy consumption is assumed to be 70-watt hours per ton-mile at the rims of the car wheel. Cars are operated on one-hour headway.

1.—CAPITAL COSTS.

Considering only the electrical equipment of the two systems under comparison and leaving out items that are common to both, such as right-of-way, roadbed and track, telephone, etc., the average capital cost per mile of single track for equipping the 100-mile interurban road (or 100-mile section of single-track steam road) with a 11,000-volt, single-phase system and 600-volt direct-current alternating-current systems, is as follows:

Equipment	Average capital cost per mile of single track. 600-v. standard A.C.-D.C. system.	11,000-v. single-phase system.
10 cars: direct current, $10,000 each; alternating current, $13,500 each	$1,000	$1,350
Electric power plant, 1000 kw.: direct current, $120 per kw; alternating current, $120 per kw	1,200	1,200
High-tension transmission line	650	1,000
Sub-stations: direct current, 10 substations costing $140,000; alternating current, 4 substations costing $25,000	1,400	250
Direct-current overhead trolley and bonding of track	2,150	....
Alternating-current overhead trolley, catenary construction, with wooden poles and track bonding	....	3,200
Direct-current, low-tension feeders, per mile	2,000	....
Totals	$8,400	$7,000

2.—OPERATING EXPENSES AND FIXED CHARGES.

The operating expenses of the 600-volt direct-current-alternating-current system and the 11,000-volt single-phase system may be considered as practically the same, except in the particulars noted below, in which the latter system shows quite a material saving. A detailed comparison is as follows:

(a) A reduction in the fixed charges results from a lower capital cost as given in the previous schedule.

(b) A reduction in the cost of labor is due to the absence of attendance, in substations, which is required by the rotary converter or motor-generator substation forming a part of the alternating-current—direct-current system.

(c) A reduction in the average losses occurs in the single-phase system between power-house and cars, thereby requiring less generated energy at the power house.

What seems to be a fair comparison of the average efficiency of the two systems in their entirety from main-station switchboard to rims of car-wheels is made up as follows:

	Average operating efficiency, per cent. 600-volt direct-current—alternating-current system.	11,000-volt single-phase system.
Power-station step-up transformers	97	97
High-tension transmission system	95	95
Substation step-down transformers	95	95
Substation rotary converters	83	..
Distributing system	85	90
Car equipment (complete)	75	72
Average over-all efficiency main-station switchboard to rims of car-wheels	47	57

With the above average efficiencies the energy required at the power-station busbars per ton-mile would be for the

(a) 600-volt direct-current—alternating-current system $\frac{70}{0.47} =$ 149 watt-hours per ton-mile.

(b) 11,000-volt single-phase system $\frac{70}{0.57} =$ 123 watt-hours per ton-mile.

The density of traffic on the average interurban system operating cars on an hour headway, including extra runs made, approximates 15,000 car-miles per mile of track per annum. Taking this figure as representing the traffic density on the 100-mile road, the ton-miles per mile of track per annum for the two systems would be:

(a) Alternating-current—direct-current 600-volt system = 40 × 15,000 = 600,000 ton-miles per mile of track per annum.

(b) 11,000-volt single-phase system = 42 × 15,000 = 630,000 ton-miles per mile of track per annum.

Since the average energy consumption per ton-mile at the power-station busbars required by the alternating-current—direct-current 600-volt system has been found to be 149 watt-hours per ton-mile, and as this system has a traffic density of 600,000 ton-miles per mile of track per annum, the total energy consumption at power house per mile of track per annum in this case is 600,000 × 149 = 89,400 kw-hours per mile of track per annum.

Similarly, the total power-house energy consumption per mile of track per annum for the single-phase 11,000-volt system is 630,000 × 123 = 77,490 kw-hours per mile of track per annum.

An itemized statement of comparative operative costs and fixed charges covered by the three elements for the two systems as enumerated above are as follows:

	Per mile of track per annum.		
	600-volt direct-current—alternating-current system	11,000-volt single-phase system.	Saving in favor of single-phase system.
Annual fixed charges at 11 per cent of capital cost.....	$924	$770	$154
Substation labor required for 10 rotary substations—one man in each at $900 per year, two shifts, total cost, $18,000	180	....	180
Taking 0.5 cent as the amount per kw-hour covering that portion of the fuel, water, oil and supplies which is proportional of the output of the station, results in a cost for the 600-volt direct-current—alternating-current system of 89,400 kw-hours at 0.5 cent.....	447	....	....
11,000-volt single-phase system, 77,490 kw-hours at 0.5 cent.	....	387	60
Totals	$1,551	$1,157	$394

Applying the above saving of $394 per mile of track per annum (due to use of single-phase system) to the case of the average proposed interurban road parallel to the 4600 miles of steam roads previously considered, the estimated loss of profit to the latter under single-phase operation would be $350 + $394 = $744 per mile. This is 10.6 per cent on $7,000, the investment per mile required to electrify the average single-track section of a steam road for local passenger traffic. The total estimated loss of profit to this 4600 miles of steam roads, due to proposed interurban competition of the latter, which if equipped with the single-phase system, would therefore be 4600 × $744 = $3,422,400 per annum—truly quite a formidable figure when calculated for the total proposed mileage. While but an estimate of the future, it may not be far amiss, and it is an indication of what losses the steam railroads will likely sustain based on past experiences of a similar nature.

It should be noted that, in order to be conservative, no credit has been given the electrical system for the value of the steam locomotive and possibly other steam railroad equipment, released from electrified section, for use on other parts of the system. This is quite an important item, as it would reduce the net average cost of equipping the portion of the steam road under consideration.

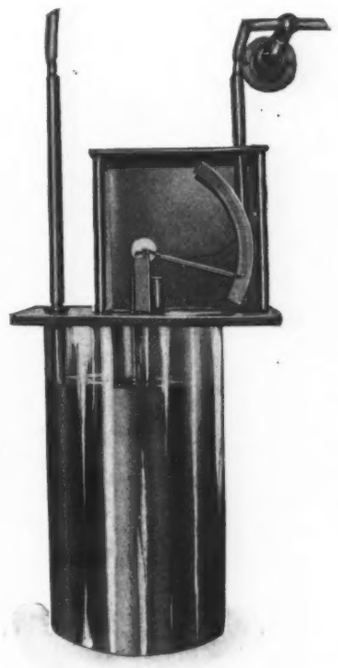
The economy effected by the use of the single-phase system over the alternating-current—direct-current system will not only tend to render competition between steam and parallel interurban roads, which are equipped with the former system, more strenuous for the steam road, but will doubtless greatly increase the number and extent of interurban roads that will be built in the field at present belonging exclusively to the steam road, unless the latter take the proper measures, to prevent the construction of parallel interurbans, and the consequent dissipation of the chief source of their passenger earnings, by electrifying their lines.

In conclusion, the writer cannot do better than quote from the admirable paper entitled "The Relation of the Interurban to the Steam Road," read by Mr. T. Jay Tomlinson, of the Pennsylvania Railroad, before the Association of Transportation and Car Accounting Officers, held at Chicago, Dec. 10 and 11, 1907. What Mr. Tomlinson has to say should carry considerable weight as coming from a steam railroad man connected with one of the principal railroad systems in the United States. He sums up the present situation as follows:

"The tendency and demand of the day are for frequent, rapid service—rapid at frequent intervals rather than one or two very fast trains and a sparse, slow service. The immediate problem of the steam roads is to provide such service at lowest costs as will retain their revenue or see it taken by aggressive competitors who also contemplate attracting freight traffic. The apparent solution is electrification of existing steam lines for passenger service."

High-Tension Electrostatic Voltmeter.

Considerable difficulty has been encountered in measuring very high pressures, although many types of instruments are utilized which give satisfactory results for electromotive force up to 25,000 volts. Accurate readings can be obtained by using a transformer, if all leakage is prevented, and non-inductive resistances may be utilized to advantage as multipliers. Other high-tension instruments have been designed with condensers



HIGH-TENSION ELECTROSTATIC VOLTMETER.

in series, employed as multipliers. But difficulties have been encountered due to the various frequencies employed, it being hardly possible to construct an instrument with the same dielectric coefficient as the condenser.

The voltmeter described below has given excellent results. It is of the electrostatic type, and was recently designed by Prof. August Grau, of Vienna, Austria, for measuring electromotive force not exceeding 90,000 volts.

The apparatus consists of a glass jar filled with oil which is used as a dielectric, with a glass plate resting on three supports at the bottom. A metallic cylinder is supported on this plate, forming one plate of the voltmeter, the connections being made to this cylinder, which is 5 3/5 in. high and 8 in. in diameter by a wire placed in a porcelain tube passing through the oil. A smaller cylinder, 4 2/5 in. long and 1 1/5 in. in diameter,

is placed concentric with the larger cylinder suspended by a copper wire surrounded by a glass tube. A thin plate is attached to the lower end of this small cylinder with a lead weight of 200 grams under the plate. A glass rod projects from the weight to hold the movable system, which is concentric with the large fixed cylinder. There is also a fine wire passing over a pulley connected with a counter weight, the pulley having the pointer attached to it and multiplying the suction of the cylinder, which travels up and down, the proper reading being indicated on the scale. The other side of the high-tension circuit is connected to the movable system, the conductor passing to the pulley through a porcelain tube, while in order to damp the motion of the cylinder a plate is fastened to the lower end of it. There are three friction rollers fastened to the glass plate which holds the glass rod in position, the latter passing through an opening in the plate.

There should be a wide field of usefulness for this electrostatic voltmeter in measuring the electromotive force of high-tension energy transmission lines and apparatus.

Remarkable Improvement in a Central-Station Load.

It is rare that we can direct attention to so notable an improvement in a central-station company's load within a period of a few months as has recently taken place at Winona, Minn. The Winona Railway & Light Company had a load factor (ratio of average to peak load) for November, 1906, of 33 per cent, and for December of the same year, 36.2 per cent. In November, 1907, this had increased to 56.8 per cent, and in December, 1907, it was 53.5 per cent. The lowering of the load factor for December, as compared with November, was due to factories closing for the holidays and because of the business depression. The explanation of this improved condition lies mainly in the increase of connected motor load. In December, 1906, the connected motor load was 1016 horse-power. In the summer of 1907 Mr. A. V. Schroeder, formerly of Springfield, Ill., took the management of the company and began a vigorous campaign to get motor business from the numerous small factories in the town, as well as from some of the large ones. As a result of these efforts, 810 horse-power in motors was added during 1907, bringing the total horse-power of motors connected up to 1826 in December, 1907, with an improvement in the load factor as already noted. The soliciting was done by the manager. These motors range in size from 2 to 60 horse-power. They are mainly between the sizes of 5 and 15 horse-power. The population of the city is about 20,000.

The kw-hour output for 1906 was 1,222,000, and for 1907 2,490,000. Of course, much of this motor business was taken at low rates, but that it had a most beneficial effect financially is indicated by the fact that the gross power earnings increased 110 per cent over 1906, and the light earnings 40 per cent. The increase in lamp load has been equal to 5148 lamps of 50 watts capacity. The connected lamp load now equals 25,345 such lamps. There are 800 electric irons connected. Winona is one of the banner small cities of the country in the number of electric automobiles used; there are 35 such vehicles in the town. A 110-220-volt charging circuit is run to the garages from the down-town district, where direct-current service is given. The rate for automobile charging is 5 cents per kw-hour.

The foregoing figures make a rather remarkable showing, especially in view of the fact that there is competition from another central-station company in the same city, the rival company having water power to supply a part of its output. As a result of this competition, lighting rates have been cut to pieces both in residence and business districts, current being sold by the Winona Railway & Light Company at 3 cents per kw-hour on the main business street, and correspondingly low rates in residence districts. This competition has resulted in a liberal use of electric light, but at such absurd rates that there is, of course, practically no profit in the lighting end of the business. In fact, the experience of this company the past year seems to be a striking demonstration of the fact that it is not the short-hour lighting business that enables a central station to pay. The company furnishes arc lamps and Holophane and "Arcburst" clusters free. Lamp renewals are free. Many Gem lamp units are in use.

OPERATING ECONOMIES.

The increase in net earnings for the year were due to increase of gross earnings and reduction in operating cost per kw-hour. The company has a modern station equipped with two 500-kw Curtis turbines three years old. Considerable reduction has been made in the cost of fuel per kw-hour by changing to a cheaper coal, as well as by the improved load factor on the station. Formerly Hocking Valley or three-fourths screenings were used which cost $4.10 per ton. The coal now used is from the Zigler field in southern Illinois. It costs $2.65 per ton. This coal is high in b.t.u. and low in sulphur as compared with many other Western coals. The station is now consuming 6.06 lb. of coal per kw-hour, which is practically the same that it was consuming formerly with Eastern coal costing $1.45 per ton more.

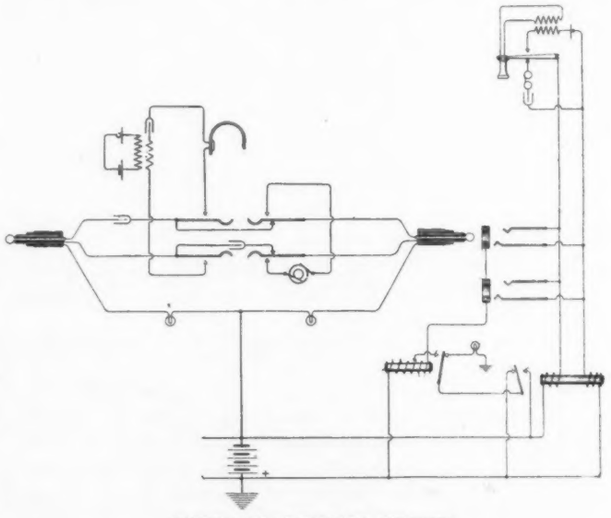
Another economy has been the substitution of steam-driven circulating pumps for the condensers in place of motor-driven pumps. By heating the feed water with the exhaust steam from these circulating pumps, the temperature of the feed is kept at 212, while before it was at times as low as 140 deg.

The Winona Railway & Light Company is now controlled by the La Crosse Water Power Company, which has built a dam at Hatfield on the Wisconsin River. The power station is two miles below the dam, and the water is utilized at a 96-ft. head. Two 45,000-volt transmission lines will be run to Galesville, from which point two lines will be run to Winona and two lines to La Crosse. The initial power development, for which machinery has been ordered, is 8000 horse-power. There will be two 4000-hp wheels. Eight thousand horse-power more will be available. The steam turbine plant at Winona is to be enlarged to form a steam reserve for the water-power plant.

New Telephone Patents.

NEW CIRCUITS.

A common-battery switchboard circuit of rather simple design is here shown in the invention of S. B. Fowler, of Lafayette, Ind. It will be seen that the cord circuit contains



FOWLER SWITCHBOARD CIRCUIT.

no relays, the two relays of the line circuit serving all purposes. When the line relay operates, it closes the line lamp circuit. This is in turn broken by the operation of the control relay, the resistance of which is so high as not to permit the

illumination of the supervisory lamp. The control relay in its operated condition connects a shunt to one of its windings as far as the back contact of the line relay. When this latter falls back, the shunt, without releasing the control relay, permits the flow of normal current in the supervisory lamp.

Whenever it becomes necessary to combine automatic and manual systems in the same exchange, the trunks must be adapted to terminate as lines of the automatic on one end, and as manual lines at the other. In such cases, the trunks are assigned some line number, or the equivalent of it in the automatic system, and a sending apparatus must be provided at the manual end for sending calls toward automatic subscribers. Such a trunk forms the subject of a patent granted to C. S. Winston, of Chicago, and assigned to the Kellogg Switchboard & Supply Company. This circuit is so arranged that in case an operator at the manual end makes a misplug, the correction of the error will have no effect on the setting of the automatic. However, as soon as the call is over, the disconnection of the trunk allows the apparatus to restore. This is accomplished by a plug-seat switch socket, which controls the restoring circuit. The contacts become operated only when the trunk plug falls home upon its seat.

PARTY-LINE LOCK-OUT SYSTEMS.

With common-battery party-line one of the simplest means of lock-out control is a high-resistance relay bridged across the line at each station, these relays being so proportioned that all will be shunted out by the use of any of the stations. There are three recently issued patents for systems depending upon this principle. W. M. Bruce, Jr., of Springfield, Ohio, employs a relay which will operate to close the talking circuit of a calling station, if the line be clear, and will hold up in the operated position while its own station-talking apparatus is connected. However, with this condition existing none of the relays at the other stations will start to operate even though their circuits be closed.

A. E. Poole, of Wheeling, W. Va., has obtained patents for two systems. In both he uses a double-wound relay, one winding of which at the calling station becomes a part of the controlling circuit. With this holding winding circuit closed, all other relays are shunted out. With this opened, as with a push-button key, a second station can come in on the line with the first. When the receivers are returned to the hooks, both operating and locking coils are de-energized.

HARMONIC RINGING.

Harmonic ringing is usually accomplished by tuning the bell vibrators to different distinctive pitches, each corresponding to the pitch or periodicity of one current supply. There has been issued to W. W. Dean, and assigned to the Kellogg Company, a patent in which a ringing relay supplements the bell. This relay nominally maintains a shunt about the bell at its station. When the reed of the harmonic relay becomes actuated by the arrival of current of the proper rate, its end strikes a rather inert pendulum-like contact device and drives it with cumulative effect away from its contact and there holds it. The bell thus relieved of its shunt operates to call the subscriber. The relay at each station of any line must fail on all but its particular frequency of current, and the bell at each station must, of course, operate upon currents which affect its relay.

POCKET TELEPHONE SYSTEM.

A novelty in telephone systems is covered by a patent issued to N. L. Weingott, of Warsaw, Russia. This system contemplates a series of jack boxes attached to the lines and located at convenient places, and a pocket telephone apparatus to be carried about on the person of the subscriber for service. This telephone terminates in a plug for the jack box, so that any convenient one may be used. The jack boxes are adjustable to several different settings, each of which requires a different kind of plug. It is proposed to rent plugs for a certain period, at the end of which time all jacks will be readjusted. At this time then all subscribers must turn in their old plugs and rent new ones to meet the new adjustment.

COMBINED SIGNAL AND TELEPHONE SYSTEM.

A combined messenger, telephone and fire-alarm system has been invented by J. G. Nolen, of Chicago. A series of thermostats control a circuit associated with a master messenger call box. This box is set and latched, but upon the operation of any thermostat of the series it releases. One code wheel sends in an alarm to the messenger office, while another sets up a peculiar and distinctive flashing of the telephone line lamp of the particular line at the switchboard of the telephone company.

CABLE TERMINAL.

Mr. F. B. Cook, of Chicago, has obtained a patent for another one of his multiple cable terminals with removable arresters. In this case, two rings or bands in parallel planes and set one above the other, form supports for the wire terminals and for the arresters. A pot-head must be used on the cable branch, the wires from which feed the top ring of terminals. Four wings at right angles serve to hold the rings and four guides for the cylindrical metal cover.

LETTERS TO THE EDITORS.

Congress and Wireless Telegraphy.

To the Editors of Electrical World:

SIRS:—The public has probably little idea of the serious menace to the future of wireless telegraphy which is offered by the Hale bill to regulate wireless telegraphy, now before Congress. Strenuous efforts have been made by government officials to force the ratification of a proposed international agreement drawn up at the International Wireless Conference held in Berlin, Germany, during October and November of 1906. This agreement, which was to take effect June, 1908, necessitated action by the present Congress, and was referred to the Committee on Foreign Relations, of which Senator Cullom is chairman. The committee for a month or more had hearings at which various departments of the government and wireless companies were represented, and the matter was finally pigeon-holed. Not to be balked, however, the Navy Department fathered the bill now before Congress, which embodies all the evils contained in the Berlin agreement.

It would be interesting to know whether the various government officials are acting blindly or are knowingly attempting to force legislation that will have the immediate effect of arresting the development of a valuable art and deprive the public of a service that would in time give them trans-oceanic telegraphy at one-tenth the rates now paid for cable service.

The bill, which would give the government full control of the wireless field, deals with existing conditions without considering the fact that wireless is still in its infancy and is making enormous strides each year. Where would our telegraph service be to-day had the government taken control of it in the forties and said there could be only one wire between two places? It is true that there is a great deal of interference between wireless stations to-day, but is it to the best interests of all to have the government take control and say there shall be only one station in a given locality for the reason that another nearby station would cause interference? It would be far better to let the situation stand as it is and give inventors an opportunity to overcome the present difficulties; and from my practical work in this field, I know that it will not be many months before this is accomplished.

Under the proposed act we would be compelled to go to the government for a license whenever we wished to build a station, in which case a permit would be granted if the station is to be in a locality distant from other stations. For instance, assume that we desire to establish an independent trans-Atlantic wireless service, and we apply to the government for a permit, the locality being, say, somewhere on the New England Coast. There are already numerous stations the entire length of the coast, and if we were fortunate enough to obtain a permit at

all it would be with restrictions to hours during which none of the other stations cares to operate. Moreover, is it to be supposed that the telegraph and cable companies will, if the Hale bill is enacted, remain passive and allow us to establish trans-Atlantic service when a protest and a little influence used in Washington will prevent it?

The telegraph and cable companies have been very persistent in publicly ignoring wireless telegraphy as a competitor, but a recent circular issued to the managers of all its offices by the Western Union Telegraph Company indicates the real attitude. In this circular it is ordered that all messages offered by the Marconi Company for transmission to points on this side, must be treated as local messages, be dated at Glace Bay, N. B., and be charged for at the local rate. "Code messages cannot be accepted in such messages, which must be fully addressed in accordance with the rules governing the transmission of domestic messages. If the Marconi wishes to give any indication of other origin, they must do so in the body of the message. The message must be checked at full commercial rate, whether addressed to a newspaper, individual or firm. Messages addressed to parties on the other side routed via Marconi wireless or Glace Bay, cannot be accepted. We will, however, of course, accept messages addressed to the Marconi Company, or anyone else at Glace Bay, but no other direction or indication can appear in the address. Such messages should be checked at full commercial rates, and the tolls to Glace Bay only collected. We cannot under any circumstances accept the Marconi tolls or anything beyond Glace Bay on these messages, but must treat them solely and wholly as local messages between the point of origin and Glace Bay."

It is very easy to read between the lines of this circular and note that the telegraph companies are realizing their danger from competition; and with the government innocently (?) acting in their interest, the public would be deprived of all the benefits of legitimate competition.

As for the development of wireless telegraphy, we have only to compare the present conditions in Great Britain and this country. When the Marconi Company was first formed it obtained a 10-year license or contract from the English government; as a result it is the only company to-day in England, and the English battle-ships have only such apparatus as the Marconi Company can give them. On the other hand, in the United States there are now seven or eight companies in vigorous competition, which has resulted in improvement of apparatus and increase of efficiency to such an extent that our navy to-day stands first in wireless and holds the record for long-distance marine communication. Our merchant marine is also getting the advantage of competition and receiving wireless service at reasonable rates, while the English merchant marine is compelled to use the Marconi system or none, and at whatever price demanded.

As to the grievance of the government with respect to interference, I may cite a case that happened on the Sound last fall. A government message was being sent from Washington to Newport via Fire Island (all land stations); complaint was made because Sound boats interfered with the transmission and it was asked that boat work should cease when government plants were sending. In time of peace, and when both the Western Union and Postal Telegraph Companies are rendering efficient service between Washington and Newport, is it just to make such a demand and use wireless to the detriment of the service of boats which are dependent wholly upon the wireless?

It is lack of capital that is holding back the development of wireless telegraphy, which lack is largely due to the uncertain status of the industry owing to threatened interference by the government; but, even with dearth of capital, I firmly believe that within five years, barring government interference, we will see it successfully competing with cables and trunk lines, and that trans-oceanic rates will be cut down to a fraction of what they are to-day From my experience and observation, I am thoroughly convinced that within 10 years the laying of trans-oceanic cables will entirely cease, and while the use of the present cables will undoubtedly be continued, the wireless system will be installed and maintained at a cost less than what would be the interest on the cost of a new cable.

The art of wireless telegraphy is still young. Scarcely a decade has passed since its practical value was first demonstrated. Important improvements are constantly being made, and with increasing knowledge of etheric radiation inventors will still further perfect the art unless all incentive to do so is removed by governmental action such as the Hale bill authorizes.

Providence, R. I. Walter W. Massie.

Grounding the Secondary.

To the Editors of Electrical World:

Sirs:—In your issue of March 14, on page 545, in commenting on the Bulletin of our Electrical Committee, the following statement is made in regard to matter of Rule 13 A:

"Despite the fact that the Committee on Rule 13 A had conferred with committees from the National Electric Light Association, Association of Edison Illuminating Companies, American Institute of Electrical Engineers and the National Electrical Inspectors' Association, on the grounding of low-potential circuits, it is not ready to accept the amended rule which has been suggested by these interests in the conference and asks that the matter be referred back to them for further consideration and report."

To be in accordance with the true statement of the case, this paragraph should have read as follows:

Owing to the fact that the Committee on Rule 13 A, appointed at the request of the electrical interests to confer with committees from the National Electric Light Association, Association of Edison Illuminating Companies, American Institute of Electrical Engineers and the National Electrical Inspectors' Association has been offered no opportunity for such conference and were not advised of the rule for grounding low-potential circuits suggested by these interests, until Feb. 5, which was five days after the limit fixed for any matter to appear in the advance Bulletin, it was decided, after consultation with the representatives of the electrical interests, that owing to the impossibility of giving the matter careful consideration in season to have it included in the Bulletin, the only course which could be pursued was to insert the recommendations in the Bulletin for the information of all concerned and ask to have the report referred back to the committee for further consideration. This course was taken by the committee so that consideration might be given and final action taken in season to include the result in the October supplement, which would be the first opportunity of sending out any of the results of the March meeting generally, because the committee were fully convinced that the lack of opportunity to give this proposed rule consideration was entirely due to oversight on the part of interests whose aim is to have harmonious co-operation on all such subjects, and the committee therefore expressed themselves as desirous of doing everything in their power to avoid any embarrassment on account of complications which had arisen.

With this correct statement of the facts in the case the second sentence of the paragraph in question probably would have been modified by you also.

Boston, Mass. C. M. Goddard,

Secretary Underwriters' National Electric Association.

[The facts above presented were not stated in the advance Bulletin sent out by the Underwriters' National Electric Association. The committee on Rule 13 A was appointed last March to report on a subject which has been a bone of contention between the electric lighting and insurance interests for years. The underwriters have always been averse to making the grounding of secondaries mandatory on the plea that a fire risk is introduced, and have refused to recognize the humanitarian side of the question. The grounding of alternating-current services is quite common among electric lighting companies, and the rules proposed do not differ radically from those now in force except that the word "must" is substituted

for the word "may," which would prevent differences between insurance inspectors and electric lighting companies and contractors. We are happy to receive Mr. Goddard's assurance that definite action on the amended rule suggested by the other interests in the conference will not be long deferred. In view of the loss of life so frequently occurring from contact with ungrounded secondaries, we sincerely hope that such action will be taken at the earliest possible moment.—EDS.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Classification of Single-phase Motors.—J. JONAS.—An illustrated article in which the author proposes the classification of all single-phase motors into three main groups, those of each main group into three sub-classes, and those of each sub-class into three sub-divisions. The three main groups are distinguished by the principle of producing the field magnetism; they are series, shunt and compound wound respectively. The three sub-classes are distinguished according to the method in which the energy is supplied to the motor, whether it is supplied by conduction to the rotor, or to the stator, or to both. The three sub-divisions are distinguished by the special kind of field generation according to whether the rotor is excited or the stator is excited or both are excited. In order to eliminate one distinction, it is recommended always to assume that the armature magnetomotive force in single-phase motors is neutralized in general; when that is not the case the machine should be called a non-neutralized motor. Symbols are proposed to designate the different possible types.—*Elek. Zeit.*, Feb. 27.

Single-phase Motor.—A note on a recent British patent of the British Thomson-Houston Company (Gen. Elec. Co.) for a single-phase motor without a commutator, but possessing the characteristics of a direct-current series motor. The motor is of the repulsion type, as only the field winding is connected to the supply system. The rotating member is a ring on which is wound a ring winding and also a drum winding, both divided into sections, a section of the ring winding being in series with a corresponding section of the drum winding. Inside the ring is a stationary iron core set at about 45 deg. to the axis of the main field, thus shunting part or all of the main field flux. Electromotive forces, induced by transformer action in portions of the ring winding, send currents through the corresponding portions of the drum winding, which set up a field in space quadrature to the primary field flux. A reaction between the stationary and rotary members is produced in consequence, thereby causing the ring to rotate. No e.m.fs. due to rotation are produced in the ring winding, but e.m.fs. are generated in a section of the drum windings to oppose the e.m.fs. induced by transformer action in the ring winding. The current and torque are thus reduced as the rotor speed increases.—Lond. *Elec. Eng'ing*, Feb. 27.

Synchronizing Induction-Motor-Generators.—L. FLEISCHMANN.—It is general custom to start motor-generators consisting of a direct-current generator and an induction motor with short-circuited armature in such a way that the motor is first brought up to synchronism by means of the direct-current machine, and the primary winding is then connected to the alternating-current network. This method is based on the assumption that at synchronism a motor absorbs only the no-load current. This assumption is correct for the stationary running period, but is wrong for the period between the starting moment and the moment of connecting the stator to the alternating-current network. There occur, therefore, current rushes and oscillations, the production of which is explained by the author with the aid of diagrams.—*Elek. u. Mash.* (Vienna), Jan. 19.

Interpole Railway Generator.—D. L. GALUSHA.—An illustrated article giving some data on the design of two 2700-kw railway generators of the interpole type used in one of the stations of the Boston Elevated Railway Company.—*Stone & Webster Pub. Serv. Jour.*, March, 1908.

Rotary Converters.—E. J. BERG.—A continuation of his illustrated serial. The present installment deals especially with copper losses at different power factors.—*Gen. Elec. Rev.*, March.

Lamps and Lighting.

Metallic-Filament Lamps.—H. REMANÉ.—An illustrated paper on the new metallic-filament lamps, their qualities and their commercial importance. The description is apparently based on the practice of the German Welsbach Company. While the method of making the tungsten filament is not described, it is said that the various changes which the osram-lamp filament undergoes during its manufacture are similar in principle to those of the osmium filament. The manufacture of the osmium filament by the paste method is described as follows: In the first place a paste is made by mixing fine osmium powder with suitable binding agents. This paste is pressed through diamond orifices by means of high pressure into fine filaments, which, after they have been dried and the binding agent carbonized, are ready for the forming process. During the forming process the filaments are heated up to incandescence, first at a low temperature, later at a higher one—as high as the filament will withstand and much higher than the temperature reached subsequently by the lamp. The heating up of the filaments is done in an atmosphere of gas containing water and hydrogen. During this process the carbon is entirely removed, and the metal powder of the filament is sintered together to an almost absolutely homogeneous filament which can hardly be distinguished from one made out of molten metal. The osmium filament (likewise the osram filament) is materially altered through the processes which it has undergone. Already during the drying and heating process its diameter and its length have been reduced considerably, and during the forming process its dimensions have still further decreased in consequence of the sintering. If, for instance, the diamond orifice through which the filament has been passed had a diameter of .0925 mm, the diameter of the filament after the heating process is .076 mm, and after the forming process is .030 mm. After the forming process osmium and osram filaments are treated in a similar way. They are sorted in accordance with their resistance, because, of course, only filaments of equal resistance can be used in the same kind of lamp. After the filaments have been connected to the leading-in wires by a kind of welding process and have been fitted in their holders, they are put in the bulbs in a similar way to the ordinary carbon filaments. The bulbs are exhausted in the usual manner. It is necessary merely to work with more care and accuracy. After the vacuum is obtained the osram lamps are tested in order to remove those which show faulty manufacture. Afterward the lamps are photometered and the caps are put on; a second test takes place after the capping, and the lamps are finished ready for dispatch. It is evident that this fairly complicated method of manufacture requires a well-organized and complicated system of control and inspection. Tantalum differs from osmium and tungsten since it can be drawn into wire just like iron, but the tantalum filament has the disadvantages of requiring a higher specific power consumption and of having a short life on alternating-current circuits. Some tests of osram lamps concerning the great constancy of the filament during its entire life and concerning the change of candle-power with varying voltage are given. The present rate of production of the German company is given as about 18,000 osram lamps per day. The percentage of power emitted as light is larger with tungsten lamps than with incandescent mantles.—Lond. *Elec. Eng.*, Feb. 21.

Tungsten-Oxide Lamp.—A note on a recent British patent of the British Thomson-Houston Company (Allgem. Elek. Ges.) for the preparation of tungsten-oxide lamps. A metallic-tungsten filament is heated to a temperature of approximately 500 deg. C. in a chamber with a limited supply of oxygen. This filament is reheated to a high temperature in a vacuum. The filament then consists entirely of tungsten oxide, WO_2, and it is claimed to have a longer life than the ordinary metallic filament.—Lond. *Elec. Eng'ing,* Feb. 27.

New Lamps.—A note stating that the English company selling the tantalum lamp has reduced the price of the 16-cp lamp to 62 cents. The price of the "Sun" bulb lamps remains the same; that is, 87 cents. Another note states that the "International Glow Lamp Syndicate" of Berlin has sold during the past year almost as many carbon incandescent lamps as in the preceding 12 months. This result has been achieved notwithstanding considerable sales of metallic-filament lamps during the past year. These are not in the hands of the syndicate.—Lond. *Elec. Rev.,* Feb. 21.

Improved Carbon-Filament Lamp.—A note on a recent British patent of the British Thomson-Houston Company (Gen. Elec. Co.) for an improved method for treating carbon filaments. The filaments are heated with a silicon-bearing substance, such as quartz, to a temperature of about 1500 deg. C. for about one hour. After this treatment the filaments are reheated in a vacuum furnace to a temperature of about 2000 deg. C. to drive out any volatile matter. "These filaments give out a white light and have a high efficiency."—Lond. *Elec. Eng'ing,* Feb. 27.

Power.

Generating Equipment of Small Factories.—P. R. Moses.—An article discussing the generating equipment of a small factory depending upon one, two or three units with a total rating of between 100 and 300 horse-power. Tables are given showing comparative figures of steam, gas, oil and water as sources of energy. It is pointed out that with the water plant omitted, the gas-producer and the gas-engine plant is more economical than steam if the coal costs more than $3 a ton, and more economical than oil fuel if the coal costs less than $4 a ton, and oil fuel more than 3 cents per gallon. The author thinks that the gas engine and gas producer will find a very much wider application in future than they do at present, and the heat now wasted in exhaust gases and in jacket water will be used in the same manner as exhaust steam in the steam engine. Different types of machines are described and illustrated. The electrical equipment for a small factory should be designed in general for 120 volts, unless special conditions make the use of alternating-current motors advisable, in which case the e.m.f. would be 200 volts.—*Eng'ing Mag.,* March.

Generating Plant at the Mine.—W. L. Affelder.—An illustrated description of the central generating station of the Berwind-White Coal Mining Company at Windber, Pa. It is a plant of unusually large proportions for a 550-volt direct-current system, since eventually it will furnish energy to six large mines with a combined output of 10,000 tons of coal a day, none of the mines being more than from one to one and a half miles distant from the plant. Electricity is used for haulage, pumping, ventilators, air compressors, etc.—*Mines and Minerals,* March.

Electric Cranes.—H. H. Broughton.—A continuation of his very long illustrated serial. In the present installment the author discusses the resistors necessary for starting and controlling the speed of crane motors. The usual starting currents for the several motors are given, and also an equation enabling the total resistance of the starter to be determined. The author concludes with a description of the three types of starting resistors generally used.—Lond. *Elec.,* Feb. 14.

Electricity in Gas Works.—An illustrated description of the electric equipment of the new municipal gas works in Goerlitz-Hennersdorf, Germany. Direct current at 220 volts is distributed by the two-wire system for lamps and motors. Energy is generated by two steam-driven 110-kw dynamos. There are 105 incandescent lamps and 20 arc lamps, while the aggregate rating of the motors is more than 100 horse-power, motors being used for driving coke crushers, elevators, pumps and for haulage.—*Bull. Siemens-Schuckert Company,* Jan. 30, 1908.

Switzerland.—A continuation of the article on technical features of hydro-electric plants in Switzerland. In the present installment the author deals with the water turbines, the types used for high, for medium and for low falls, the methods used for regulating the turbine speed, and the wear and tear of the turbines. The article is to be continued.—*L'Ind. Elec.,* Feb. 25.

Traction.

Snow-Fighting Equipment.—J. Ralph.—An illustrated description of the snow-fighting equipment of the cars of the Houghton County Street Railway Company. All cars have track scrapers and sand boxes on each end. One of the greatest difficulties experienced in past winters was, however, the formation of ice in the center of the track. To remove this, double root track scrapers of heavy construction are used on double-truck cars, while on single-truck cars right-angle nose ploughs introduced last winter have proven very successful.—*Stone & Webster Pub. Serv. Jour.,* March.

Conduit System.—F. R. Roose.—The first parts of a paper on the conduit system used on the tramways of the London County Council and especially on the differences between former and present construction.—Lond. *Elec. Eng.,* Jan. 17, Feb. 21.

Installations, Systems and Appliances.

Automatic Voltage Regulator.—An illustrated description of the Dick voltage regulator which is used on the Vienna-Baden single-phase railway. Two types of this regulator are manufactured, one for direct-current and the other for alternating, but the principle is the same in both. The connections are shown in Fig. 1. The machine *D* is the main generator, or, in the case of an alternating-current system, the exciter. In the shunt-field circuit of this machine is a rheostat *r*, and a rheostat *R*. The latter is divided up into a number of sections, connections being made from these sections to metal rings in the lower portion of the regulator, as shown in the diagram. These metal rings are separated from one another by rings of insulation, and are piled up to form a cylinder, the lower end of which is closed, and which contains mercury. A plunger *P* floats in the cylinder, and by its movement alters the level of the mercury, thereby varying the number of sections of the resistor *R*, which are short-circuited. To the plunger *P* is attached an iron core *C*, which is lifted up by the action of the solenoid *S*. *This solenoid is connected* across the mains, the voltage of which is to be regulated, in series with a rheostat *W* and a series resistor *w*. The action is as follows: If the voltage of the mains decreases, the m.m.f. of the solenoid *S* decreases; the plunger falls and causes the mercury to rise and short-circuit more sections of the resistor *R;* this causes an increase in the exciting current of the machine *D,* and a consequent rise in voltage. In the case of a high-pressure alternating-current system, the solenoid *S* and the resistors *W* and *w* are connected in series with the secondary of a transformer, the primary winding of which is joined across the main high pressure busbars. The adjustment, in the first place, is made by means of the hand-regulated resistors *W* and *r*. Where several alternators are working in parallel and are excited by one machine, only one regulator is needed. This is placed in the field circuit of the exciter, as is shown in the illustration, and by this means the voltages of all the generators are regulated simultaneously. This is the method in use at the power station of the Vienna-Baden single-phase railway at Lees-

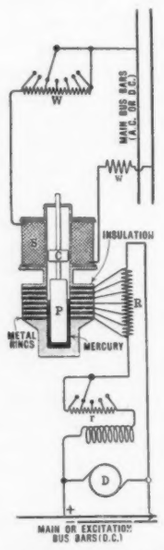


FIG. 1.—AUTOMATIC VOLTAGE REGULATOR.

dorf. The solenoid *S*, in series with an adjusting resistor and a series resistor, is in this case in the secondary circuit of an oil transformer, which transforms down from 10,000 volts to 110 volts. An alternative arrangement in the case of an alternating-current generating station is that in which each generator has its own exciter, which may be either shunt or compound wound. Each exciter has a regulator of the continuous-current type in its field circuit, the solenoid of which consists of two windings. The inner windings are connected in parallel across the terminals of a small auxiliary continuous-current generator, driven by a synchronous motor connected to the alternating-current mains. The outer windings are in series, and are connected in the main circuit of the auxiliary continuous-current generator. In this main circuit are also an adjustable resistor and the variable resistor *R* of a regulator of the alternating-current mains, either direct or through a transformer, according as to whether the main voltage is low or high. This arrangement works in the following manner: The inner windings of the continuous-current regulators tend to hold up the plungers, thus leaving all the sections of the resistor *R* in circuit. The outer windings act in an opposite direction, and tend to overcome the m.m.f. of the inner windings, thus letting down the plungers and short-circuiting some of the sections of the resistor *R*. Should the voltage of the system fall, the resistor of the alternating-circuit regulator is short-circuited; the current in the main circuit of the auxiliary generator increases; the m.m.f. of the outer windings overpowers that of the inner windings, and the field currents of the exciters are increased. The regulators can be adapted to suit practically any arrangement for excitation.—Lond. *Elec. Eng'ing*, Feb. 27.

Wires, Wiring and Conduits.

High-Tension Cables.—R. APT.—A paper read before the Berlin Elec. Soc'y. on high-tension cables for energy transmission. Impregnated paper is now universally employed for insulation. The paper used for high-tension cables has an average perforation e.m.f. of about 20,000 volts per mm of thickness. Formerly attempts were made to render the insulation resistance as high as possible. Modern practice, however, differs from this, since insulation resistance and perforation strength are independent of each other. Moreover, highly insulated materials generally render the proper insulation hard and brittle, especially at low temperatures. For energy transmission over long distances three-phase currents are generally used. Concentric three-phase cables, which were the first to be used, have almost entirely been abandoned in favor of three-conductor cables. The rules of the German Association of Electrical Engineers forbid the use of concentric cables for e.m.fs. above 3000 volts. However, with increasing e.m.f. the construction of three-conductor cables also offers difficulties, and in general it is not advisable to make three-conductor cables for e.m.fs. above 30,000 volts, at least when transmission over a long distance is intended. For e.m.fs. above this value the older type of the single-conductor cable is to be used, and the author believes that for very high voltages these are the cables of the future. The author then gives a review of the theory originally due to O'Gorman showing that the different layers in the insulating material of a cable are subjected to very different dielectric stresses according to their distances from the conductor. O'Gorman has suggested the use of "graded" cables, but the present author thinks that the present methods for doing so will not be much used in practice except in special cases. He then discusses the losses in single-conductor cables, giving first the formulas for the losses in the lead cover. For iron-armored cable there are also hysteresis and eddy current losses in the iron. The author thinks it is not impossible that on account of the lower cost of the transmission line, the series direct-current Thury system may play a more important rôle in energy transmission in the future than heretofore. Especially for cables, direct current has important advantages. The author shows that in the case of transmitting considerable amounts of energy over long distances through a cable, the single-phase system has advantages over the three-phase system. The author finally describes a high-tension cable installation which has been made by the Allgem. Elek. Ges. for the County of Durham Electrical Power Distributing Company, in northern England. In this case, a cable of more than 100 km has been laid for the first time for a voltage of 20,000. It is a three-conductor cable, and the following tests were specified: Each cable section was first tested in three-phase connection for 24 hours at 30,000 volts. The cable was then tested at 50,000 volts for 15 minutes, and finally all three conductors were tested against the lead cover for 15 minutes at 50,000 volts. It was also specified that a piece of cable after bending three times and back around a diameter 12 times its own, should still withstand an e.m.f. of 80,000 volts for two minutes. After the cable had been laid, the whole line was tested at 40,000 volts between the phases and the lead cover for half an hour. Since the longest branches of the system are more than 12 km, and the charging current is about 3 amperes per kilometer at 40,000 volts and 40 periods, the tests were made with the aid of a choking coil, as indicated in Fig. 2 where *A* is a double-pole switch, *B* the starting water resistor, *C* a voltmeter, *D* a regulation resistor, *E* an ammeter, *F* transformer, *G* voltmeter, *H* choking coil, *J* ammeter, *K* protective device for excess voltages, and *L* liquid resistor for this protective device. The leading charging current of the cable was compensated by the lagging current of the choking coil so that the testing transformer had to be dimensioned according to only the losses, and, therefore, was of small size. This method is said to have proven very successful in all cases where great

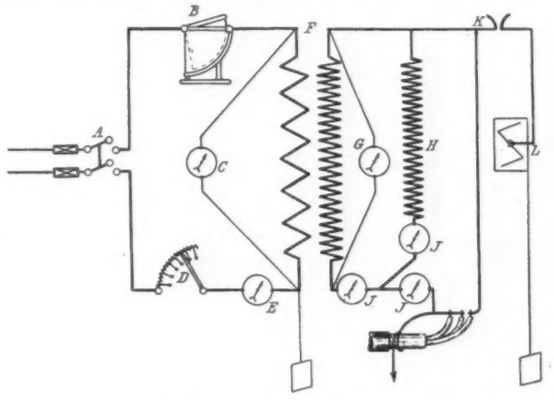


FIG. 2.—TESTING HIGH-TENSION CABLES.

lengths of cable were to be tested at high voltages. In the discussion which followed the reading of the paper, Schrottke stated that lightning storms are not such very dangerous enemies of overhead transmission lines as is sometimes thought. On account of the very high cost of cables compared with overhead transmission lines, the latter will be almost universally used in future, and only in special cases on short portions of a line, where special conditions prevail, say, up to 20 km length, will cables be used. Apt agreed with him in this respect to a certain extent, but said that a modern cable, though more expensive, is more reliable with respect to continuous service than an overhead line built according to the latest principles and provided with the best protective devices. Lichtenstein thought that it would take quite a while before cables for an e.m.f. of 40,000 volts would be built, and that reliable three-conductor cables which can be built for this e.m.f. are cheaper than single-conductor cables.—*Elek. Zeit.*, Feb. 20 and 27.

Electrophysics and Magnetism.

Flames as Rectifiers.—A. CATHIARD.—The author showed some time ago that a flame may act as a rectifier for an alternating current of high tension and low intensity. The unidirectional character of the discharge is confirmed by the oscillograph. He now announces that in this case a true disintegration of the cathode is produced. It is accompanied by the appearance of a very brilliant point on the cathode, whereas the anode is merely surrounded by a diffuse violet tuft. If two identical parallel electrodes, say, two cylinders, are mounted in

the same horizontal plane, and one of them is immersed in a flame containing no solid conductors in suspension, the electrode so immersed is always a cathode. On transferring the flame to the anode it at once becomes the cathode. The experiment is easily shown with cylindrical rods of homogeneous close-grained carbon, which are specially suitable for anodes.—*Comptes Rendus,* Feb. 3; abstracted in Lon. *Elec. Eng'ing,* Feb. 20.

Electrochemistry and Batteries.

Electrometallurgy of Iron and Steel.—S. A. Tucker.—The conclusion of his illustrated article giving a summary of the present condition of electrometallurgy of iron and steel. In the present installment the author deals with the processes of Kjellin, Keller and Girod.—*Gen. Elec. Rev.,* March.

Entropy.—E. Kohl.—A mathematical paper discussing the entropy function in the interchange of chemical and electrical energy.—*Ann. d. Phys.,* 1908, No. 1.

Units, Measurements and Instruments.

Torsion Meters.—J. H. Gibson.—A paper read before the North East Coast Institution of Engineers and Shipbuilders on torsion meters as applied to the measurement of the power of marine steam turbines.—Lond *Elec. Rev.,* Feb. 14.

Speed Indicator.—S. Herzog.—An illustrated description of a speed indicator of Swiss make, especially intended for railways, registering the mean speed in one second and also showing the total length of run.—*La Lumière Elec.,* Feb. 8.

Telegraphy, Telephony and Signals.

Measurement of Wave Lengths in Wireless Telegraphy.—C. C. Monckton.—With the approach of the international control of radio-telegraphy, the standardization of wave meters has become a matter of considerable importance and standard international inductances and capacities are required. The author has recently measured the wave lengths of several ship installations about 50 miles distant. It was afterward established that his measurements were within one-half per cent of those taken on the ships with standard inductances and capacities of another nation. These tests were made with the apparatus shown in Fig 3. *J* is a single turn of inductance coil in the aerial circuit, and *I* is the coil of standard inductance, its distance from *J* being capable of variation. *K* is a standard air condenser of variable capacity, *D* is a detector, *P* a potentiometer arrangement, and *T* a telephone receiver. The two receiving circuits are brought into tune by varying the inductance of *L* and the capacity of *K*. The coil *I* is then moved

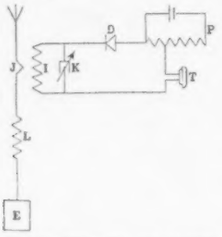


FIG. 3.—MEASUREMENT OF WAVE LENGTHS.

away from *J* till the sound in the telephone receiver is just audible; it will then be found that, when the circuits are in good tune with the sending station, if the capacity is altered in the slightest degree either way, the sound in the telephone receiver is lost. The wave-length λ can then be calculated from the formula: $\lambda = 60{,}000\sqrt{CL}$, where *C* is the capacity of the condenser in microfarads, and *L* the inductance of the movable coil in millihenrys. This method of measuring wavelengths may be employed up to distances where signals can be received satisfactorily.—Lond. *Elec. Eng'ing,* Feb. 20.

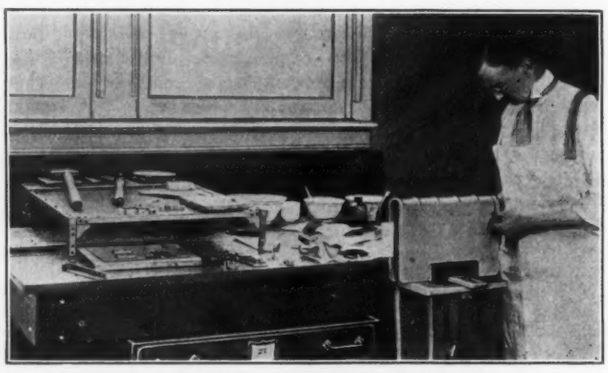
Telephone Rates.—At the recent general meeting of the (London) National Telephone Company, G. Franklin discussed at length the question of message rates versus unlimited-service rates. He quoted some remarks of the Postmaster-General that some unlimited-service subscribers who originally made 3000 calls per year had, in the course of a few years, increased this number to 11,000 per year, using the same line. Franklin also stated that the National Company had many cases of flat-rate lines used to such an extent that 24 per cent of the total calls had become ineffective owing to the lines being engaged. Some subscribers thought nothing of sending from 250 to 300 calls per day, with the result that nobody else could get into communication with them. Moreover, it is peculiar to the telephone business that the larger the number of subscribers, the greater the capital cost per subscriber; the following illustration of this was given: With an exchange for 1000 subscribers, the capital outlay on switchboards and junctions would be $20 per subscriber, but if there were 10,000 subscribers, the capital cost would be $65 per subscriber.—Lond. *Elec. Eng'ing,* Feb. 27.

Miscellaneous.

Porcelain.—E. L. Barringer.—An illustrated article on the manufacture of porcelain for electrical purposes. There are two classes of electrical porcelain, namely, dry-process porcelain and wet-process porcelain, the difference being that in dry-process porcelain the mixture of raw materials is reduced to the form of a damp powder and pressed into shape in steel dies in screw presses; whereas in wet-process porcelain the raw material is mixed to a stiff mud or dough, made into a blank form, partially dried, and turned on a lathe to the final shape. Dry-process porcelain is used for wiring fixtures, knobs, cleats, receptacles, attaching plugs, switch bases, etc. Wet-process porcelain is used for high-tension insulators, such as are necessary for oil switches, transmission lines and transformers. This porcelain is more dense, and possesses a higher insulating value than the dry-process porcelain. The different steps in the manufacture of both classes of electrical porcelain are described and illustrated.—*Gen. Elec. Rev.,* March.

Hand-Tool Heater for Bookbinders.

Electric heat in the bookbindery presents decided advantages over gas. Being absolutely clean it prevents spoilage, and being more efficient, reliable and convenient, it enables the workman to devote more attention to his work and to get better results.



BOOKBINDERS' ELECTRIC HEATER.

One of the most successful of the electrical devices now manufactured for the bookbinder is the Hadaway hand-tool heater. It consists of an electrically heated plate surrounded by a platform of heavy wire fabric. It is large enough to heat a number of tools at a time, and the platform provides a suitable support for the handles of the tools being heated, and a convenient place to cool off the tools that have been used. This method of heating the tools is much more expedient and satisfactory than individual heating and does away with the tangle of flexible cords or small gas pipes that would otherwise be required. It permits greater freedom to the workman and enables him to always maintain the exact temperature required.

The extreme simplicity of the device is shown by the accompanying illustration. It is manufactured by the Hadaway Electrical Heating & Engineering Company and sold by the Westinghouse Electric & Manufacturing Company.

Portable Cable-Testing Galvanometer.

To meet a demand for a high-sensibility portable galvanometer for use under conditions and in places where the laboratory types cannot be used, the Leeds & Northrup Company, of Philadelphia, have placed on the market the instrument illustrated below.

This instrument consists of one of its high-sensibility galvanometers slightly modified and mounted on a light tripod.

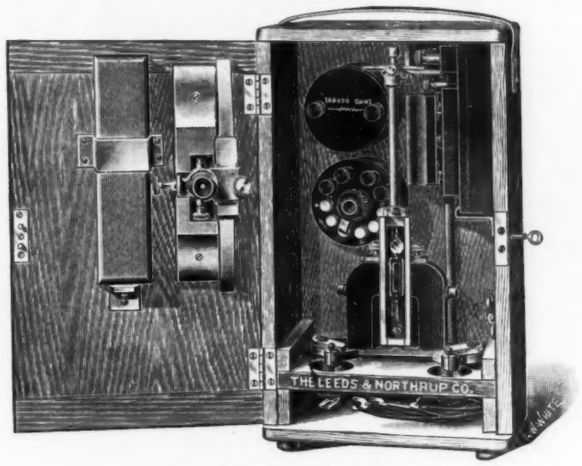


FIG. 1.—GALVANOMETER IN CASE.

It has ample sensibility, is quick in its action, has a positive zero and is dead beat. The tube containing the suspended system and the magnet are constructed in two units so that the tube may be removed and another substituted at any time;

FIG. 2.—GALVANOMETER ON TRIPOD.

or, if any adjustments are to be made to the coil or system, the tube can be removed from the magnet and laid horizontally on the table. The entire system is visible by means of the open-glass front given to the tube. This glass front slides in grooves and will come out readily. A simple device on the back of the instrument clamps the coil when not in use, while a spring in the top of the tube relieves the strains on the suspension while the instrument is unclamped. The suspension, thus protected, is not readily broken.

The entire galvanometer is insulated from earth by means of the three leveling screws. These screws are made in part of hard rubber so shaped that they are "petticoated." Two small indicators, one mounted on the coil and the other on the galvanometer, enable one to level the galvanometer so that the coil always comes to exactly the same position in the field.

The readings are made with a small high-power telescope carried at the end of a short, removable arm. The optical system is so arranged that it is easy "to find the scale." The galvanometer is clamped to the tripod by a wing nut.

With the exception of the tripod the galvanometer complete with repair outfit packs in a case 8 in. x 9 in. x 15¼ in. The illustrations show the galvanometer mounted on the tripod and packed in its box, together with an Ayrton shunt, 100,000 ohms and battery key. A condenser may also be packed in. Such an equipment combines the advantages of the portable combination sets with those non-portable sets made up of a number of individual instruments.

Wire Connectors.

To eliminate the crudeness and expensiveness of soldered connection, especially those made on the outside line wires, the Yonkers Specialty Company, Yonkers, N. Y., is manufacturing a line of connectors and taps for use without solder. Fig. 1 shows a flat two-way connector. To a flat brass plate is attached an upper plate of spring brass. The end screws, which hold the wires, are tapped into the base plate. The spring

FIG. 1.—FLAT TWO-WAY CONNECTOR.

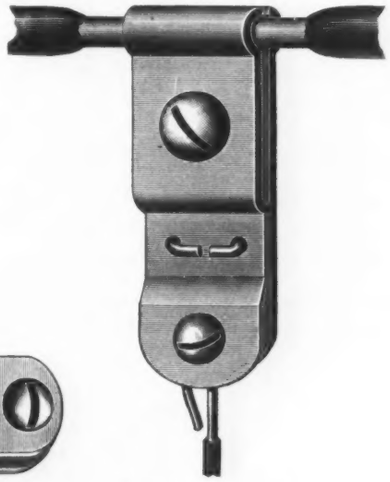


FIG. 2.—FLAT TAP CONNECTOR.

brass serves as a washer plate and also keeps the screws permanently locked. Fig. 2 shows a flat tap connector for joining small branch wires to main-line wires. The jaws, which are adapted to a variety of sizes of main-line wires, are tightly secured by a large screw and nut.

Electrical Apparatus for Laboratories.

In districts embracing chemical industries, laboratories, etc., the central-station manager might increase his sales of electrical energy by recommending the use of such devices as centrifugal machines, rotating and stirring motors, bottle shakers, vacuum pumps, electrically heated ovens, etc. The International In-

strument Company, of Cambridge, Mass., builds a line of such machines. Chemists find it economical to hasten the precipitation of fine sediment by the use of centrifuges. Fig. 1 shows a

FIG. 1.—HIGH-SPEED CHEMICAL CENTRIFUGE.

machine designed for this work, ball bearings being used and a special motor wound for speeds up to 3000 r.p.m. Chemical

FIG. 2.—SUGAR AND SALT DRYING CENTRIFUGE.

laboratories are usually equipped with electricity and the advantages of the electric motor for performing many operations

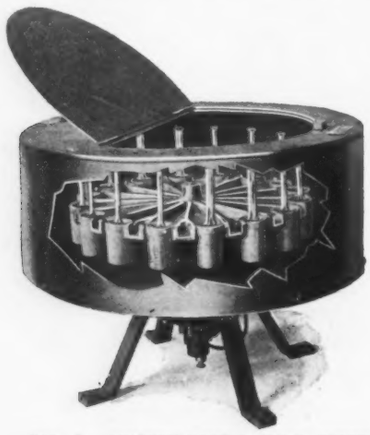


FIG. 3.—SIXTEEN-BOTTLE MILK TESTER.

quickly is readily appreciated. A sugar and salt drying, cylindrical-basket centrifuge is shown in Fig. 2. Almost every dairy and public health laboratory regularly tests the quality of milk by the Babcock method. Hand and steam-driven machines are still frequently used; but these are easily replaced by electrically driven testers. It is also part of the business of health

FIG. 4.—CENTRIFUGE FOR TESTING BACTERIA IN MILK.

departments to test milk for bacteria and an instrument for readily doing this work is shown in Fig. 4. This centrifuge is made especially for this purpose.

Time Switch for Electric Circuits.

The Campbell Electric Company, of Lynn, Mass., is the manufacturer of the eight-day time switch shown herewith. The switch is said to possess many novel features, chief among which is the isolation of the knife switch in a compartment separate from that of the clock mechanism. Like other time switches on the market, the clock-work mechanism may be set to throw the switch into and out of circuit at any predetermined time, it being possible to set the mechanism to operate

EIGHT-DAY TIME SWITCH.

to the minute. The manufacturer claims that the device is water- and dust-proof, and that the quick-break feature of the knife-switch mechanism eliminates injurious arcing at the contacts. The company also builds a time switch for high-voltage service. In this type of switch, the circuit is opened in oil. Switches of the latter type are designed for operation on circuits having potentials as high as 3000 volts. The time switches for low-potential circuits are rated at 25, 50 and 100 amperes, the blades being spaced for 250 volts. The switches are made with double and triple poles.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Sentiment in the industrial world during the last week was more optimistic, there being considerable improvement in general distributing trade. The excellent weather was favorable for farm work, and reports from the winter wheat crop are good. Actual progress is slow; collections are backward, and the prices of staples, as for some time past, tended lower; but the spring-like weather extending over a large area, stimulated the volume of spring business. Securities advanced somewhat, as shown by the sale of $5,000,000 50-year 4 per cent tax exempt bonds in New York, which were 16 times oversubscribed, and which brought what is probably the highest basis price ever obtained in this country for other than a government bond. Building operations show an increase of about 12 per cent over January, but are 40 per cent below the operations of February, 1907. Gross railway earnings for February show a decrease of 9.6 per cent from February a year ago. In general, the iron and steel trade has not developed during the last week as much as was expected, but the tone shows improvement. *Bradstreet's* reports business failures for the week ending March 12 number 276, against 287 last week, 186 in the like week of 1907, 187 in 1906, 186 in 1905, and 193 in 1904. The wire trade, especially electrolytic wire, shows considerable activity, and a heavy demand is expected by spring. There is considerably more activity than a week ago in the whole electric field. The Westinghouse Electric Company reports a greater export business for this February than for February a year ago. The Western Electric Company, in line with the policy of practically all the large companies and most of the smaller ones, has for some time past been reducing operating expenses, outstanding indebtedness, and bringing the ratio of production nearer to the ratio of demand. Electrical people are far from discouraged over the situation, for the electrical business is recovering more rapidly than many other lines of trade.

WESTINGHOUSE COMPANIES.—Reports from the various Westinghouse companies show an excellent volume of business and a number of large contracts, especially in export trade. The Westinghouse Lamp Company, which, by order of the New York and New Jersey Federal courts, was taken from the receivers and returned to the stockholders, is again doing business under the executive officers as formerly. The management announces that during the receivership the company was operated at a considerable profit, and that there was no cessation in the usual development and productive work in the factories. Operations have been begun in the new factory at Watessing, N. J., and arrangements are now under way to concentrate all the manufacturing at that point. The new buildings, completed last summer, are entirely of concrete, and admirably adapted for the purposes for which they were erected. When operated at full capacity the new plant will have an output of 15,000,000 incandescent lamps yearly. The business of the Electric Company shows, so far for March, a substantial increase over the same period in February, and the export branch was in excess of the same corresponding period last year. The company is operating about 60 per cent of its normal capacity. It developed last week that the Lackawanna & Wyoming Valley Rapid Transit Company, owned by the Westinghouse Electric & Manufacturing Company, defaulted on the interest due Feb. 1 last, on its first mortgage 5 per cent bonds. To protect the interests of the Westinghouse Company Judge James S. Young, in the United States Circuit Court, made an order allowing the receivers, E. M. Kerr, T. H. Given and H. S. A. Stewart, to pay $150,000 to the Mercantile Trust Company of New York, and to receive coupons of bonds deposited as collateral. Nearly all of the bonds of the transit company are owned by the Westinghouse Company, and plans have been made for the leasing of the road. According to the order of Judge Young the receivers are to receive $100,000 treasury bonds of the Lackawanna Company as security for the interest payment. Through a quiet agreement signed by 90 per cent of his creditors, an extension of time on his personal debts, amounting, it is estimated, to be about $8,000,000, has been granted to Mr. George Westinghouse. This three-year agreement will, it is stated, tie up 60,000 shares of the Westinghouse Electric & Manufacturing Company stock, and 30,000 shares of Westinghouse Air-Brake stock. With the announcement that these shares will not come into the market a better market should follow for the Westinghouse stocks. The annual meeting of the district managers of the Westinghouse Electric Manufacturing Company was held at the general offices of the company in East Pittsburg last week. There were twenty-three managers present, and the gathering was to discuss the prospective business in their various territories. It was learned from one of the managers who was present that the general tone was hopeful. He said: "Our men from the Western part of the country were a unit in the opinion that they did not look for any falling off in the business for the coming year from that of last year, which was one of the best years in the history of the company. The Eastern men, however, were not so sanguine: indeed, they freely expressed themselves that they did not look for a repetition of the prosperous time which prevailed during the first nine months of 1907. They had already experienced a great diminution in trade. But even they felt that the worst was over, and that many indications had shown themselves within the last 30 days which would lead them to the conclusion that in a general way business would begin to pick up again from now on, and that on the whole the electrical business of 1908, compared with 1907, would not show as great a loss as had been anticipated."

ALLIS-CHALMERS SALES.—Among recent sales of the Allis-Chalmers Company are the following: Electric generators, motors, transformers, etc., to leading coal companies: The Elkins Coal & Coke Company, Morgantown, W. Va.; Big Coal Company, of Pittsburg, Pa.; Berwind-White Coal Mining Company, Windber, Pa.; East Tennessee Coal Company, Jelico, Tenn.; Frick Coal & Coke Company, Pittsburg, Pa.; McKell Coal & Coke Company, Kilsyth, W. Va.; United States Coal & Coke Company, Gary, W. Va.; Ellsworth Coal Company, Ellsworth, Pa.; W. J. Rainey Company, Connellsville, Pa.; Merchants' Coal Company, Boswell, Pa.; Woodward Iron (& Coal) Company, Woodward, Ala.; Somerset Coal Company, Jennerstown, Pa.; Pittsburg Coal Company, Grindstone, Pa.; Monongahela River Consolidated Coal & Coke Company, Milesville, Pa.; Buffalo & Susquehanna Coal & Coke Company, Du Bois, Pa.; Norfolk & Western Ry. Company's Coal Mining Department, River Coal Company, National Mining Company; various subsidiary companies of the United States Steel Corporation and other iron and steel plants, and numerous smaller operators scattered throughout the anthracite and bituminous coal producing sections of Pennsylvania, West Virginia, Ohio, Indiana, Illinois and the South.

THE BUSINESS SITUATION.—Mr. E. M. Herr, general manager of the Westinghouse Electric & Manufacturing Company, says that, in his opinion, the low-water mark in business was reached last January; that the month of February showed a marked improvement, and that the first two weeks' business in March gives further indications of improvement. He said: "We have in our works about 8500 men employed regularly at present, which is 75 per cent of our normal force. The small work, apparently, has not been much affected. The number of orders received for small motors and switchboard appliances has been very large. For heavy machinery there has not been a great demand, but our repair department has been rushed. During the last two months we have done more repair work than for a year. Our foreign business is also keeping up splendidly."

BARCELONA ELECTRIC TRAMWAY PLANT.—In the Feb. 7 issue of the *Gaceta de Madrid* it was announced that the Compania del Ferrocarril de Sarria, Barcelona, Spain, has applied for a concession for an electric tramway in Barcelona and that a period of one month from the date of publication has been appointed for the presentation of proposals.

SPEEDY FINANCIAL RECOVERY EXPECTED.—Inquiries among the telephone, telegraph and cable companies show that the period of financial stress through which the country has just passed and from which it is rapidly recovering, has not affected these lines of business nearly so much as similar crises in the past. All of them have suffered with the rest of the commercial world, but all of them report considerable improvement in the immediate past and prospects for an early return to normal conditions. Speaking for the Commercial Cable Company, Vice-President C. G. Ward sums up the situation in the telephone and telegraph field. "There is, perhaps, no better barometer of business conditions," he said, "than the cable business, which responds to every marked change of conditions in the financial world. While our company has suffered along with the rest we have not felt the effects of the panic nearly as much as we did after certain panics in previous years. Moreover, conditions have improved so much in the last two months and our business has held up so well in the last six weeks, that it seems almost safe to prophesy that we will recover more quickly from this last panic than ever before. The reason for this is not a mystery, for any one can see that we have no fundamental causes for continued depression, such as overproduction or short crops. On the contrary, the farmers are wealthy and the American people are too impatient to let things stagnate for any length of time unless they are compelled, which is not the case at present. However, the Presidential year is always more or less of a deadweight. Business slackening has taken place so many times in the past during the prenomination period that business men have come to regard this slowing down as a natural and normal occurrence which must be reckoned with in forecasting the business year. The 1906 year was a phenomenally prosperous period, one that cannot be taken as a criterion. Any recovery from a period of financial stress must, in the nature of things, be more or less slow. But we are satisfied with a gradual increase and satisfied to take from two to three years to attain the height of prosperity from which we may fall in a month or a night. Business history is a record of such rises and declines, and in this particular instance it seems to me that the recovery from the fall will be more rapid than ever heretofore."

Western Union officers anticipate an increase in the telegraph business in the spring. The company is doing a normal business, everything considered, and conditions are improving, but in the last few months the Western Union's business was smaller than in the same period during previous years. "The business of the company is picking up," said Secretary Brewer, "and we expect a further increase in April as conditions now indicate."

WESTINGHOUSE APPARATUS IN MEXICO.—In 1906 Mexico was third among the large importers of electrical machinery from the United States, being exceeded by British North America and the United Kingdom. In 1907, with electrical imports valued at $1,551,562, Mexico headed the list. Indications point that 1908 will equal, if not surpass, the record of last year. The Westinghouse Electric & Manufacturing Company has just completed important and extensive installations for various companies in Mexico. These include a 500-hp rotary converter with switchboard appliances for the Guanajuata Consolidated Mining & Milling Company which will operate mining machinery; several large-sized motors for the La Tula Mining Company, and a number of electric motors for the Lake Chapala Company, which will drive an equal number of centrifugal pumps forcing water over the territory of the Chapala Company for irrigation purposes. In one of the mining camps of Guanajuata, the Pinginco mines, 250 Westinghouse electric motors are operated, ranging in capacity from 5 hp to 200 hp. The largest soap factory in the Republic of Mexico, which produces 82 per cent of the entire soap used in that country, has ordered recently from the Westinghouse Machine Company and the Westinghouse Electric & Manufacturing Company a duplication of its power generating plant for the operation of its works, consisting of a gas producer, a gas engine, an electric generator and the necessary switchboard appliances. The company also uses between forty and fifty Westinghouse motors to operate some of the soap-making machinery in its works. The San Rafael Paper Manufacturing Company, which is situated about 36 miles from the City of Mexico, has recently completed the installation of a large number of motors varying in capacity from 10 hp to 150 hp. They will be used in the operation of machines and tools in the company's factory. The electric current is obtained from the Mexico Light & Power Company at a potential of 20,000 volts. Six 120-kw oil insulated transformers reduce this current to a working pressure of 440 volts. A switchboard to control the various transformers and motor circuits is furnished with the contract as well as a number of individual switchboard panels located near each motor. This installation is considered the most modern and economical plant of its kind in the Republic of Mexico.

ELECTRICAL DEVELOPMENT COMPANY.—At a meeting of the directors of the Electrical Development Company, held in Toronto on March 10, it was reported that the value of the property is $17,000,000 or $18,000,000 and that the company had paid all its liabilities, including $140,000 interest on the bonds. At the end of the year there was a deficiency of $160,000, which showing was considered good in view of circumstances. The old board of directors was re-elected and the present officers are as follows: President, Sir Henry M. Pellatt; first vice-president, Mr. Frederic Nichols; second vice-president, Mr. William Mackenzie. The chairman stated that the company had done everything possible to make some arrangement with the government, but so many limitations and curtailments of the area in which the company was to operate were asked that the negotiations had been terminated. On the same day Prime Minister Whitney made a statement to the Legislature on the subject of the company. He said that a proposition had been made to the government to take over the company's plant and transmission lines, but this could not be considered, as the administration had practically concluded an agreement to take its supply of power from the Ontario Power Company. There were also agreements by which the government was bound not to generate energy at Niagara. To secure possession of the company's plant and transmission lines, the Province would have to incur a liability of more than $20,000,000.

BRITISH TELEPHONE COMPANY IN MEXICO.—With a capital stock of $1,000,000 a British company with headquarters in London is being formed to install an extensive system of long-distance and local telephone exchanges in Southern Mexico. It is planned to expend more in the proposed improvements than the amount of the capital stock. During the preliminary work Francisco Alfaro, a well-known lawyer of Mexico City, is the representative of the company in Mexico. The company will operate under a concession which Manuel S. de Corbera and J. Sitzenstatter, of Mexico City, obtained from the Federal government for a long-distance line between Mexico City and Vera Cruz, including the building of various lines in the state of Vera Cruz and the establishment of exchanges in the cities of Vera Cruz, Cordova, Orizaba and other places. Besides telephones, the concession gives the right to establish wireless telephone stations throughout the territory in which the company will operate. Work has already been begun constructing underground telephone systems and more than 5 kilometers of conduits have already been laid in Vera Cruz. Telephone cables in the other towns will also be placed underground. The new enterprise is being vigorously supported by Governor Dehesa, of Vera Cruz.

NEW BALTIMORE ELECTRIC COMPANY.—There will be a hearing soon at Annapolis on the project to obtain a charter from the Maryland Legislature for a new electric lighting company in Baltimore. The connection of John W. Van Dyke, vice-president of the Standard Oil Company of Pennsylvania, has given rise to the report that Standard Oil interests are behind the plan. The new lighting company proposes to operate in connection with the Baltimore Heating & Refrigerating Company, using the steam generated for heating to run its plant before being turned into the heat mains. This, it is claimed, will not interfere with the heating qualities of the steam.

ELECTRICAL SUPPLY BIDS ADVERTISED.—The Bureau of Supplies and Accounts, Washington, D. C., will open bids on March 31 for a quantity of electrical supplies for the Navy Department, including cross arms, insulated wire, steel enameled conduit, fuses, 18 motors, rubber tape and miscellaneous electrical supplies. The following bids will be opened April 14: 21,800 ft. of single conductor, one 10-hp motor and miscellaneous electrical supplies.

WESTINGHOUSE GETS INTERBOROUGH LAMP CONTRACT.—Recently the annual contract to supply incandescent lamps for the entire Interborough Rapid Transit system was awarded to the Westinghouse Lamp Company. This includes lamps for the Subway, the elevated stations, cars and tunnel lighting. It is estimated that the Interborough company uses 350,000 lamps yearly, mostly of 16 candle-power.

THE WEEK IN COPPER.—During the week there was a better buying movement on the part of the domestic consumers, and while this buying was only in small lots and for contracts in hand, it has been gradually growing, due to the fact that the manufacturers have been forced to take larger amounts owing to the increase in the volume of orders for finished material. Manufacturers also report a much larger volume of inquiry which will take a good tonnage of the raw metal. Stocks in the yards of consumers are now almost nil, and, under ordinary conditions, they would be buying for six months ahead. It is a matter of history that the American consumer has never taken advantage of the low prices of metal to make long engagements, as is invariably done by the European consumer. On Monday the market touched 13c., with a majority of the dealers holding firm at that price, and many experts expressed an opinion that the market is now on the high road to further advancement. The export movement has dwindled enough to allow the foreign manufacturers to handle their present stocks, and it is thought that if the price is shaded again that the foreign demand will support the market as formerly, even if home consumers persist in staying out. Exports from the port of New York since March 1 have been 10,662 tons, and European statistics of copper for the first half of March show a gain of 1210 tons in stocks, while the amount afloat increased 1520 tons. The exports from Atlantic ports for the week ended March 12, were 7100 tons, and since the first of March 9376 tons. The rumor that producers have again entered into an agreement to maintain prices seems to please the palate of Wall Street, but in copper circles there is nothing to substantiate the report, as selling interests are actively competing for what small business there is to be had. Closing prices on the Metal Exchange Monday were as follows:

Lake	12¾@13c.
Electrolytic	12⅝@12⅞c.
Castings	12½@12¾c.

The London Market was as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	59 2 6	59 5 0
Standard copper, futures	59 10 0	59 12 6
Market	Strong.	Irregular.
Sales of spot		200 tons
Sales of futures		600 tons

Extreme fluctuations for the year:

	Highest.	Lowest.
Electrolytic copper, spot	13¾	12¼
Lake copper, spot	13⅞	12⅜
Casting copper, spot	13½	12⅛
London, spot	£64 5 0	£56 10 0
London, futures	64 10 0	56 17 6
London, best selected	67 10 0	61 0 0

The reverberatory furnaces of the Washoe smelters of the Amalgamated Company were blown in last Friday. These smelters are said to be the largest in the world, reducing about 10,000 tons daily. It will be 60 or 90 days before any of the copper from the shipping mines will make its appearance on the market. The North Butte property is now operating to its full capacity, and the Anaconda and the Butte coalition will soon have their output up to normal. It is said that the mines are being worked with greater efficiency than for years past, and it is expected that operating costs this year will be lower than they have been in a long time. The *Boston News Bureau* figures the production of copper in the United States, Mexico and Canada for the month of February, at 65,036,750 pounds, compared with 85,288,106 pounds in February, 1907, a decrease of 20,251,356 pounds.

WESTERN EXPORT DEVELOPMENT.—Although the total business of the Western Electric Company for 1907 showed a falling off of $16,521,163 from the record of $69,245,331 for 1906, the foreign business was even larger in 1907 than in 1906. Shortly after the Western Electric Company began the manufacture of telephones in 1876, the foreign demand increased so rapidly, and the necessity for making quicker and more frequent deliveries than were possible from the American factories, led to the establishment of factories and supply houses throughout the various countries of Europe and the Far East. The first foreign house was opened at Antwerp in 1882, and other houses were subsequently established at London, Berlin, Paris, Milan, Vienna, St. Petersburg and Tokio, and selling agencies at Johannesburg, South Africa, and Sydney, Australia. From these distributing houses, supplied in part by the factories which are a part of their organization, but largely by the American factories, the business in Europe and the Oriental countries has been developed. In addition to the regular output of the foreign factories, shipments of telephones and power switchboards, street-railway generators and motors, lighting material and electrical supplies of all kinds, are made from the American factories to the foreign houses and distributed by them to the trade in their respective territories. As indicating the progressive tendencies of the Oriental peoples it is interesting to note that the telephone has been much more readily adopted by them than by some of the older countries of Europe—Russia and Italy suffering particularly by the comparison. During the past year large consignments of telephone apparatus have gone forward to Japan and China, including a large switchboard equipment especially constructed for the exchange at Seoul, Corea. This switchboard, a lamp-signaling multiple switchboard of the most approved type, has a capacity of several thousand lines, and replaces a magneto board of an antiquated pattern which the city of Seoul had entirely outgrown. The board, with the desks, power board and all auxiliary equipment, was built at the company's Chicago factory, and is now being installed by the Tokio house, through whom the original contract had been placed. The development of the business in Mexico, the West Indies, and Central and South America, which is handled by the New York house, has also been very rapid in the last few years. Hardly a steamship leaves New York harbor for South American ports which does not contain as a part of its cargo, large consignments of telephonic apparatus and electrical supplies for these countries. During the last year modern central-battery telephone systems have been installed in Mexico City, Panama, Rio de Janeiro, Trinidad and other cities of the Latin-American countries, while numerous smaller magneto switchboards and private systems have been installed throughout this entire territory. Cuba, in line with its recent industrial development, has also invested largely in telephone apparatus, a large percentage of which is the product of Western Electric factories. A feature of the export business which is frequently given very little attention by shippers is the question of packing. The export department of the Western Electric Company since its organization has made a study of this feature of the work. Shipments for export are packed by special packers in a department entirely distinct from the regular packing department, and the most careful attention is given to all the details.

ELECTRICAL EQUIPMENT FOR NEW BOSTON BRIDGE.—Contracts have been let for two electrically-driven air compressors to be used in operating the new Northern Avenue Bridge, in Boston, over the Fort Point Channel. The Ingersoll-Rand Company will supply these; and the air receivers, eight in number, and of steel construction, will be furnished by the Roberts Iron Works Company, of Cambridge, Mass. Two steam engines for turning the draw span will be supplied by the Mead-Morrison Company, of Cambridge, and the Walworth Construction & Supply Company, of Boston, will furnish and install the operating machinery. It is proposed to use compressed air under 200 lbs. pressure for operating the draw. The structure will be turned through two independent sets of gearing by two engines, operated by air instead of by steam; air-brakes being provided to regulate the swinging. The ends of the four trusses are to be raised by eight cast-steel levers lifted by air cylinders 16 in. in diameter. A centering device operated by a small air cylinder is to be used to bring the draw into exact position on closing. The air is to be compressed and stored in a power-house located on the down-stream end of the draw fender pier; this house to provide quarters for the men who will operate the draw.

CANADIAN CROCKER-WHEELER COMPANY, LIMITED.—Another promising sign of returning confidence in the business situation is the organization of the Canadian Crocker-Wheeler Company, Limited, for the manufacture and sale in Canada of the well and favorably known Crocker-Wheeler apparatus. The latter company, as is well known, manufactures practically all types of direct current and alternating-current motors and generators, motor-generator sets, frequency changers, etc. Among its specialties are direct-current motors for special purposes, such as machine-tool and printing-press drive, and steel mill work. For the latter, a line of motors has been specially developed which has been found to fully meet the very severe conditions which exist in steel mills. Crocker-Wheeler alternating-current generators up to 2000-kw capacity have been in successful operation in Canada for some years. The officers of the company are as follows: Mr. Fritz E. Lovell, president; Mr. R. A. Stinson, vice-president; Mr. F. John Bell, secretary-treasurer. The head office is located in the Street Railway Chambers, Place d'Armes Hill, Montreal.

ALLIS-CHALMERS TURBINE FOR ATHENS, GA.—The Athens (Ga.) Electric Railway Company will add a second steam turbine, of 1000-kw capacity, to its plant, which, with the generator designed for direct-connection to it, is now being built by Allis-Chalmers Company, at its West Allis shops. The unit will deliver three-phase, 60-cycle current at a terminal pressure of 2300 volts, and excitation is to be obtained from a 40-kw induction motor-generator set, also of Allis-Chalmers manufacture.

Financial Intelligence.

THE WEEK IN WALL STREET.—After three weeks of nearly complete stagnation, characterized by stubborn resistance to unfavorable news developments, the stock market threw aside its apathy, and toward the end of last week rose in leaps and bounds, closing higher on Saturday than for a long time. The movement was wholly professional, and the upward turn was lost on Monday under a rush of selling orders, but the advance was welcomed as indicative of the possibilities of the market, and undoubtedly the fundamental reason for the rise was that some of the biggest financial interests in the country have been, and are accumulating stocks. The Hill stocks were again the object of bullish manipulation, and the feature of the market on Friday was the rapid advance of Amalgamated Copper. The Gould stocks were heavy, but the United States Steel stocks showed strength in anticipation of the next report, which, it is believed, will be excellent. There were many indications of lowering rates for money, both here and abroad. The government report showed that the winter has been most favorable for crops of any in recent years. During the week the New York banks lost more than $8,000,000 cash to the Treasury, but the only result was to stiffen time loan rates a trifle. The offering of $4,000,000 of New York State 4 per cent bonds, which were 16 times oversubscribed, showed that there is abundant money waiting to rush into good investments. The process of strengthening the cash situation is still in operation. The government figures on foreign trade for the month of February show a falling off in exports of merchandise as compared with any of the preceding three months, but the total of $167,800,000, makes, nevertheless, a record for the month of February. Monday's closing quotations were as follows:

NEW YORK.

	Mar. 6.	Mar. 16.	Shares sold.		Mar. 6.	Mar. 16.	Shares sold.
All-Ch.	5½	6⅝	1,600	Int.-Met., com..	7¼*	7½	2,915
All-Ch. pfd....	14¼	17⅜	1,300	Int.-Met., pfd...	19	19¾	6,580
Amal. Cop.....	50½	55¼	292,850	Mackay Cos....	54*	56½	600
Am. D. T.....	39	39*	———	Mackay Cos. pfd.	61½	62*	800
Am. Loc.....	34¼	37	14,930	Met. St. Ry....	19	16	125
Am. Loc. pfd..	90½*	91½	2,900	N. Y. & N. J. Tel.	100*	98*	332
Am. Tel. & C'bl.	54*	50*	5	Steel, com.....	30⅜	33	477,092
Am. T. & T....	106¾	108¼*	590	Steel, pfd.....	93⅝	97¼	50,455
B. R. T.....	—	43¾	98,685	W. U. Tel.....	47½	49	3,275
Gen. Elec.....	116½	120¼	3,849	West'h, com....	40*	40	1,675
Hud. R. Tel....	—	—	———	West'h, pfd....	50	59½*	———

BOSTON.

	Mar. 6.	Mar. 16.	Shares sold.		Mar. 6.	Mar. 16.	Shares sold.
Am. Tel. & Tel..	106½	100⅜	———	Mass. E. R. pfd.	43½	47½	———
Cumb'lnd Tel...	—	106¼	———	Mex. Tel. pfd..	5	5	———
Edison El. Ill..	203*	202	———	New Eng. Tel'p.	107	110	———
Gen. Elec.....	116	122½	———	W'st Tel. & Tel.	—	7¼	———
Mass. Elec. Ry.	9¾	10½	———	W. T. & T. pfd.	—	64½	———

PHILADELPHIA.

	Mar. 6.	Mar. 16.	Shares sold.		Mar. 6.	Mar. 16.	Shares sold.
Am. Rys.....	43	42¾	———	Phila. Elec...	7¼	7¾	———
Elec. Co. of Am.	8¾	9⅛	———	Phila. R. T.....	14½	16⅝	———
Elec. Stor. B'ty.	26½	28	———	Phila. Traction..	86½	—	———
E. S. B'ty pfd..	—	—	———				

CHICAGO.

	Mar. 6.	Mar. 16.	Shares sold.		Mar. 6.	Mar. 16.	Shares sold.
Chicago City Ry.	172	150	———	Met. Elec. com..	17	17	———
Com.-Edison	86*	90	———	National Carbon.	50	52	———
Chicago Subw'y.	—	—	———	Nat. Carbon pfd.	100	103	———
Chicago Tel. Co.	109¾	112	———				

*Last price quoted.
Shares sold are for week March 9-14.

COLUMBUS EDISON.—The stockholders of the Columbus Edison Company have voted to increase the capital stock of the company from $1,000,000 to $1,500,000.

UNION TRACTION DIVIDEND.—The directors of the Union Traction Company of Indiana have declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable April 1.

MICHIGAN LIGHT DIVIDEND.—The quarterly dividend of 1 per cent on the common stock and 1½ per cent on the preferred stock, payable April 1, has been declared by the directors of the Michigan Light Company.

TO SPEND $2,000,000 IN ELECTRIFICATION.—Dispatches from Chicago state that the Northwestern & Burlington Railroad will begin to electrify the Wood Street freight yards on April 1, at a cost of about $2,000,000.

BOSTON ELEVATED PAYS DIVIDEND.—A dividend rental of $1.75 per share will be paid on April 1 on the common stock in accordance with the provision of the lease of the West End Street Railway Company to the Boston Elevated Railway Company.

UNION SWITCH & SIGNAL DIVIDEND.—At their last meeting the regular quarterly dividend of 3 per cent on the common and preferred stocks was declared by the directors of the Union Switch & Signal Company. The dividend will be payable April 10.

CANADIAN GENERAL ELECTRIC CUTS DIVIDEND.—At the last meeting of the directors of the Canadian General Electric Company the dividend was cut from the 10 per cent basis, which the company has been paying for the last ten years, to a 7 per cent annual basis. The stock of the company, which has dropped to 90 from par since the first of the year, sold as high as $235 in 1901, and as high as $178 in 1905. It was said by one in authority that the dividend reduction was merely a precautionary measure taken in view of the uncertainty of industrial conditions. The quarterly dividend of 1¾ per cent on the three months ending March 31, on the common stock, represents a ¾ per cent reduction on the 2½ per cent quarterly dividend declared heretofore. The directors also declared a semi-annual dividend of 3½ per cent on the preferred stock.

UTICA GAS & ELECTRIC BOND ISSUE.—N. W. Harris & Company are offering $1,000,000 of Utica Gas & Electric Company refunding and extension mortgage 5 per cent tax exempt gold bonds at 92½ and accrued interest, netting about 5½ per cent. This company does the entire gas business and practically the entire electric light and manufacturing power business in Utica, Little Falls, Herkimer, Mohawk, Ilion, Frankfort and other municipalities in the Mohawk Valley. It is stated that for the year ending Dec. 31, 1907, the net earnings of the company applicable to the interest on the refunding and extension mortgage bonds was more than 2½ times the interest charge. This issue of bonds is exempt from taxation by the State, counties, cities, towns, villages, school districts or other local sub-divisions therein, a rather unusual feature in connection with New York State corporation bonds. Fifty-year, 5 per cent bonds of the Utica Gas & Electric Company, to the value of $500,000 are offered by Perry, Coffin & Burr, Boston, at 92½. The gross earnings of the company for the year ending Dec. 31, 1907, were $772,728; net earnings, $399,594 and surplus, $180,094. The generating capacity of the electric plant of the company is 8000 hp at Trenton Falls, 3400 hp at Dolgeville—both hydro-electric—and 8000 hp at Utica in two steam plants.

INTERBOROUGH-METROPOLITAN BOND ISSUE.—The first hearing on the application of the Interborough-Metropolitan Company for permission to mortgage its property for $55,000,000 to secure an immediate issue of $30,000,000 in bonds for refunding present indebtedness, and the optional future issue of $25,000,000 in bonds for such additional equipment or purchase of property as might be deemed wise, was held by the Public Service Commission on Monday of this week. George W. Wickersham, counsel for the company, explained the details of the proposed mortgage and bond issue in accordance with the formal petition. Edward F. J. Gaynor, auditor of the company, testified that about $5,200,000 had been paid to capital account of the operating receipts. This money was due from capital account, he said, and would in time be paid back. After the hearing Mr. Ivins, special counsel for the Public Service Commission, said that the use of money from operating receipts for capital account was not unusual, and that it was highly creditable, as the money might have been paid out in dividends. It was also brought out that the Interborough-Metropolitan owed the Rapid Transit Construction Company, which built the Brooklyn extension of the subway, $7,431,306.71 on account of the excess cost of the work over the contract price. Already $3,300,000 has been paid in excess of the contract. The hearing was adjourned for a week.

GENERAL ELECTRIC COMPANY'S YEAR.—The annual report of the General Electric Company for the year ended Jan. 31, 1908, which will be issued in May, will, it is reported, show gross orders billed to customers of approximately $70,000,000 and net earnings for dividends on the $65,167,100 capital stock, of about $9,800,000 or 15 per cent. The share earnings for the company in the previous fiscal year ending Jan. 31, 1907, were $8,427,842 equal to 13.2 per cent on the $63,572,800 stock outstanding at the end of that year. The figures for last year establish a new high record, which was made possible by the large amount of business carried over from the 1906 year and the large volume of orders booked during the first six months of the year just ended. In the fiscal year of 1904 the company shipped to its customers a total of $41,699,617 of electrical supplies and apparatus and the total of $70,000,000 for the last year is an increase of about $30,000,000 or 70 per cent. Net earnings have increased from $7,865,376 in 1904 to about $9,800,000 last year, a gain of $2,000,000 or 25 per cent, which means that the ratio of net profits to gross earnings, which in 1904 was 18.8 per cent, declined in 1908 to 14 per cent, a shrinkage in four years of nearly 5 per cent. Since 1903 the selling policy of the General Electric Company has undergone a radical change. In 1903 the company did a gross business of $36,685,598 and net profits were $10,232,839, equal to 28 per cent of gross earnings for dividends. Results for 1907-8 show that this ratio has been cut exactly in two and in the interval gross sales have nearly doubled. The reduction in price of electrical apparatus made is stated to be in accordance with the policy of the General Electric Company that the surest way of maintaining its position in the electrical field is to accept a moderate rather than an exorbitant ratio of profit. Between 1904 and 1907 the outstanding stock has increased from $43,866,700 to $65,167,400 and the dividend percentage on the outstanding stock for the last five years beginning with 1904 was 17.9, 13.9, 13.4, 13.2, 15. The amount of business booked during the last four months of the 1907 year was about 50 per cent smaller than during the first five or six months.

WHITNEY COMPANY REORGANIZATION PLAN.—Bondholders in the Whitney Company, the $10,000,000 corporation organized to develop water power on the Yadkin River in North Carolina, and which went into a receiver's hands last month, have received an offer of a plan of reorganization. The Whitney Company went into receivership soon after the failure on the Pittsburg Stock Exchange of the firm of Whitney, Stephenson & Company. E. F. Buchanan, of the banking firm of A. O. Brown & Company, of New York, who was interested in the financing of the Whitney Company, was recently elected president of the company and is the author of the reorganization plan. The plan calls for the formation of a new company with $5,000,000 7 per cent non-cumulative preferred stock, $5,000,000 common stock, $5,000,000 first-mortgage 5 per cent 20-year bonds and $5,000,000 6 per cent second-mortgage 60-year income bonds. Present bonds are to be surrendered for 50 per cent of their face value in income bonds, and a part of the preferred stock will be allotted to all bondholders participating in the agreement. The first-mortgage bonds are to be issued to provide funds to complete the plant at not less than 80 per cent of their face value. Mr. Buchanan stated that A. O. Brown & Company had advanced in the neighborhood of $1,000,000 in cash to the company, and that his company represented about half of the $5,000,000 Whitney Company bonds. The value of the plant in its present condition is about $2,000,000, and it will take at least $2,000,000 to complete it. The company has large holdings in North Carolina and was organized for the purpose of utilizing the power of the Yadkin River. The present plant which is hoped will be completed by July 6, 1908, has a capacity of 45,000 hp and the construction of a 50,000-hp plant is contemplated later, to supply power to the cotton mills and other industries in that region. The company owns 7534 acres of land.

DECREASE IN CONSTRUCTION BY THE AMERICAN TELEPHONE COMPANY.—Construction work by the operating companies of the American Telephone & Telegraph Company for 1907 will be a great deal less than the $79,366,949 expended in 1906 on new work finished in 1906. During 1905 and 1906 the company went about the work of expansion on a large scale, and in those two years a total of more than $130,000,000 was expended, so that at the beginning of 1907 a large part surplus of primary construction all installed and prepared for last year's expansion was ready. The advancing cost of labor, materials and cost of installation work in 1907 made it necessary to cut down the expansion work contemplated. Reports from 11 of the 30 odd operating companies for the year ended Dec. 31, 1907, give a total of $20,807,972 spent in construction work, a decrease of $10,936,384, or 34 per cent decrease from the amount spent in 1906. The $20,807,972 given above is about 40 per cent of the 1906 total of $79,366,949, and estimating on this basis the construction expenditures of the Bell system for 1907 may be approximated at $50,000,000, which is practically $30,000,000 less than during the previous twelve months.

MASSACHUSETTS ELECTRIC COMPANY PREFERRED STOCK ISSUE.—The stockholders of the Boston & Northern and the Old Colony Street Railway Companies will meet on March 17, when they will be asked to authorize an issue of preferred stock not exceeding $1,250,000 for the Boston & Northern and $750,000 for the Old Colony Company. The stock is to have voting power and will call for 6 per cent cumulative dividends. The issue will be made for the purpose of retiring the floating debt of the two companies, and it is believed that such securities as the dividends are to be at the rate of 6 per cent will find a more ready market than bonds in the present financial situation.

CINCINNATI UNION GAS & ELECTRIC COMPANY REPORT.—Earnings for 16 months of the Union Gas & Electric Company, of Cincinnati, which about two years ago took over the Cincinnati Gas & Electric Company, were $481,697 after paying all charges. A 6 per cent dividend was paid on the $5,000,000 of preferred stock for the 16 months, leaving a net surplus of $81,697. While these earnings are small for the $5,000,000 of common stock, President Kenan anticipates greatly increased earnings during the coming year. The report shows large increases in all lines of business operated by the company.

CAMBRIDGE GAS LIGHT COMPANY STOCK ISSUE.—The Massachusetts Gas Commission on the petition of the Cambridge Gas Light Company to issue sufficient additional stock to yield $427,000, has approved of an issue of 2015 shares to be offered to the stockholders at $200 a share, making a total of $403,000. The proceeds of 125 shares are to cancel promissory notes, 565 shares to cancel an equal amount of obligations and 1325 shares to pay cost of additions to the plant.

COLUMBUS EDISON COMPANY STOCK INCREASE.—At a meeting of the stockholders of the Columbus (Ohio) Edison Company it was voted to increase the capital stock from $1,000,000 to $1,500,000. There is now an equal amount of common and preferred stock, and it is believed that the respective dividends of 5 and 6 per cent will be maintained.

DUQUESNE LIGHT COMPANY.—The Duquesne Light Company, of Pittsburg, Pa., is considering plant improvement involving an expenditure of $4,500,000. Mr. George R. Webb, formerly president of the Maryland Telephone Company, has been elected president of the Duquesne Company, succeeding Mr. R. C. Hall, who becomes vice-president.

PHILADELPHIA ELECTRIC EARNINGS.—It is reported that the coming statement of the earnings of the Philadelphia Electric Company will show, for 1907, an increase of about $500,000 over the preceding year, and a surplus over dividends of the same amount, an increase of $180,000 over 1906.

WEST INDIAN ELECTRIC COMPANY.—Gross earnings of $198,845 for the year ended Dec. 31, 1907, and net profits of $104,040 are reported by the West India Electric Company. Deducting the fixed charges left a surplus of $57,086, equal to 7.13 per cent on the common stock of the company.

DAYTON & XENIA'S RECEIVER.—C. J. Fernending, of Dayton, Ohio, has been appointed receiver for the Dayton & Xenia Transit Company, on an application from the Worcester (Mass.) Trust Company, which holds $300,000 of the second mortgage bonds of the road.

DULUTH EDISON REGULAR PREFERRED DIVIDEND.—The directors of the Duluth Edison Electric Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable April 1, to stockholders of record March 17.

SEATTLE ELECTRIC PREFERRED DIVIDEND.—Directors of the Seattle Electric Company have declared the regular semi-annual dividend of 3 per cent on the preferred stock, payable April 1 to stockholders of record March 12.

FIRST PAMPHLET REPORT ISSUED BY WESTERN ELECTRIC COMPANY.—The first pamphlet report issued by the Western Electric Company has been mailed to the stockholders and covers the fiscal year ended Nov. 30, 1907. Net earnings on 1906 sales were $1,217,000, against which dividends of 8 per cent, or $1,200,000, were declared, leaving a surplus balance of $17,000. The report gives total assets of $51,483,104, the decrease, $10,701,405, since Dec. 31, 1906, coming in the decrease of merchandise and bills and accounts receivable. The total of bills payable was $17,701,793, a decrease from Dec. 1, 1906, of $9,380,759. Secretary H. A. Halligan says in part: "On Dec. 31, 1906, the indebtedness of the company was $27,082,552, including a contingent liability of $4,201,189 for bills receivable discounted. The business of the preceding year had taxed the resources and credit of the company, sales averaging nearly $6,000,000 a month. Although customers had maintained a good standard of promptness in payment, the investment in accounts and bills receivable was $24,555,074. The process of reducing purchases of materials and payrolls began to be in full operation from February, 1907, and since that time the rate of production in the factories has been in fair proportion to the volume of new orders. The success of the efforts in this direction is shown by the fact that indebtedness has decreased $9,380,759, which, with an increase in cash of $1,147,425, comprises an improved financial condition to the extent of $10,528,184. Sales for 1907 were $52,724,168, as compared with $69,245,332 for the previous year, a decrease of 23.9 per cent. When the cutting down began in February and March, 1907, the initiative was taken with a view primarily to the financial condition of the company and to the necessity of reducing indebtedness. Quick assets at the end of the year were $21,025,669, or 18.8 per cent more than all the bills payable. Factory plants and warehouses are carried on the books at 51.9 per cent of their cost. At the close of the 1906 year, capital and surplus were $35,102,000, a book value per share of $234.01. After deducting $1,338,000 of depreciation and extraordinary expenses in 1907, the book value of stock on Dec. 1 last figures out $225.21."

PACIFIC TELEGRAPH AND TELEPHONE COMPANY.—For the fiscal year of 1907 the Pacific Telephone and Telegraph Company reports gross earnings of $9,223,565, an increase of $1,491,950 over 1906, and total expenses of $7,828,415, an increase of $1,561,423 over 1906. Although the net revenue of $1,395,149 was $69,474 less than the net revenue of the previous year, dividends of $1,080,000 were declared as compared with the $704,566 dividends of 1906, thus reducing the surplus from $760,057 to $315,149. During the year the total expenditures on plant and real estate were $6,174,404. The remarkable increase in gross earnings equals 19.3 per cent and the 44,801 new stations, or 17.3 per cent increase, indicate the extent of the recovery from the San Francisco disaster and the growth of telephone development on the Pacific Coast. During the year the company increased its bonded indebtedness by $8,750,000 owing to the necessity of replacing that part of the system destroyed by the San Francisco earthquake. In point of capitalization and subscribers this company is second in size to the New York Telephone Company, among the subsidiaries of the Bell.

SAN FRANCISCO UNITED RAILWAYS COMPANY DEBT ADJUSTMENT.—Pittsburg dispatches state that the Westinghouse Electric & Manufacturing Company has been authorized by the United States District Court to participate in a plan for adjusting the floating debt of the United Railways Company, of San Francisco. The Railways Company's indebtedness is about $3,500,000, of which the Westinghouse claim is $117,539. The United Railways Company will issue $3,500,000, 6 per cent notes, maturing half in August, 1913, and half in February, 1914, secured by $3,500,000 preferred stock of the United Railways Company, to adjust the debt. It is stated in the petition upon which the order was made by Judge Young, that unless some arrangement is made to meet the floating indebtedness of the United Railways Company, it will be forced into the hands of a receiver. The chief creditors of the United Railways Company, among whom are the General Electric Company and the Lorain Steel Company, are said to have agreed to the proposed plan.

NEW ENGLAND TELEPHONE.—For the fiscal year ended Dec. 31, 1907, after the payment of regular 6 per cent dividends, the New England Telephone Company will show a surplus of more than $260,000, which is equal to 0.82 per cent on the $31,697,800 capital stock outstanding. For the 1906 year the company showed a surplus of but $150,793 and surplus after dividends for the four preceding years has averaged less than $140,000. Maintenance expenditures in 1907 were conducted on an unusually liberal scale, so that if the company had handled the maintenance account on the same basis as 1906, 7 per cent could easily have been shown. It is thought that as soon as earnings warrant and a few adjustments of rates, particularly in the Boston district, have been made, the company will begin payment of 7 per cent dividends.

ELECTRIC SECURITIES COMPANY.—Following is a digest of the semi-annual statement of the United Electric Securities for the six months ending Feb. 1, 1908. Total receipts were given as $171,735, a decrease of $8,314 over the same period in 1907. Expenses of $119,276 show an increase of $20,946 over 1907, leaving a net balance of $52,459. The total income was given as $52,459, against $92,500 for 1907 and the total surplus $1,280,950, against $1,228,488 of 1907. A preferred dividend of $35,000 was declared as last year, leaving a balance of $1,245,950 on hand Feb. 1, and a surplus of $2,117,672 as compared with a surplus of $1,195,356 for 1907. The total assets of the company were given as $7,730,358.

WASHINGTON WATER-POWER NOTES.—Moffat & White and Lee, Higginson & Company, of Boston, are putting forth an issue of $3,000,000 Washington Water Power (Spokane) 6 per cent notes at 96, yielding 7½ per cent on the investment. The company owns and operates 93 miles of electric railway and supplies light and power to Spokane and the neighboring towns and to mines and manufacturing plants within a radius of 100 miles. For the year ended Feb. 29 the gross earnings of the company were $2,173,031, an increase of more than 29 per cent over the previous year. The net earnings were $908,802, an increase of 46½ per cent over 1906.

BUTTE ELECTRIC BOND ISSUE.—A special meeting of the stockholders of the Butte Electric & Power Company will be held on March 30 at Newark, N. J., to vote upon the issue of $5,000,000 thirty-year 6 per cent bonds, secured by a second mortgage upon the properties of the Butte Electric & Power Company and its subsidiaries, the Madison River Power Company and the Montana Power Transmission Company. It is proposed by this issue to liquidate the floating debt of the companies and to provide them with an additional working capital.

NEW COMPANY CHARTERS MEXICAN TRAMWAYS.—An important transaction registered during January in Mexico was the chartering of the Mexican electric tramways by a company with a capital of 8,000,000 pesos (about $4,000,000). Other important business operations which were backed by French, Italian and American capital were registered to the amount of 12,000,000 pesos, and included the construction of electric light plants at Juchitan and Oaxaca, and electric plants on the Isthmus of Tehuantepec.

RUTLAND RAILWAY LIGHT & POWER COMPANY.—For the twelve months ended March 1, 1908, the Rutland Railway, Light & Power Company reports earnings for water, power and light of $112,973, against $80,999 for 1907, and expenses of $63,153 against $51,036 for the previous year, leaving a net for 1908 of $49,820 against a net of $29,963 for 1907. The total net in all departments for the twelve months was given as $109,950, an increase of $23,409 over 1907.

RHODE ISLAND LIGHTING MERGER.—The terms of a merger bill introduced in the Rhode Island Legislature on March 11, chartering the Blackstone Valley Gas & Electric Company, give permission to acquire any gas, electric light or power company in Providence County. The capital stock of the new company is not to exceed $3,000,000 in $100 shares except that when three-fourths of the stock vote favorably there may be additional issues of stock.

AMERICAN TELEPHONE & TELEGRAPH DIVIDEND.—The directors of the American Telephone & Telegraph Company declared the regular quarterly dividend of 2 per cent at the quarterly meeting in Boston. The dividend is payable April 15 to stock of record March 19. On account of the annual meeting transfer books will be closed March 20 to March 31, inclusive.

UNION GAS & ELECTRIC COMPANY.—M. E. Moch was elected a director to succeed H. A. Nordeck, and Olaf Ussing was elected in the place of M. F. Plant at the annual meeting of the Union Gas & Electric Company, held in Cincinnati last week. The other directors were re-elected.

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

CENTREVILLE, ALA.—The Centreville Light Company has made arrangements to operate the electric light plant at this place by water power, and will hereafter furnish an all-night lighting service instead of until 11 o'clock.

NORTH BIRMINGHAM, ALA.—The City Council has decided to call an election to vote on the proposition of issuing $5,000,000 in bonds, the proceeds to be used for the construction of a water-works system and electric-light plant. If the election carries, the Council purposes to carry out the plans of Thomas H. Friel, which calls for the construction of a dam across the Warrior River near Phillips Ferry, 28 miles from North Birmingham.

SLOCOMB, ALA.—Plans are being considered for the construction of an electric light plant in the town. A. C. Kelly is interested in the project.

JEROME, ARIZ.—The Two Republics Mining Company is making arrangements to install an electric plant in the early summer to provide electricity to operate the machinery for its mines. There is a water power on the property which will be utilized to generate electricity. Paul Smyly is secretary and treasurer of the company.

PINE BLUFF, ARK.—Plans for the buildings of the Pine Bluff Light & Water Company have been completed by Ford, Bacon & Davis, of New York, N. Y., and contracts for the construction of the buildings will soon be let. A contract will also be let for the construction of a 3,000,000-gal. reservoir.

GRIDLEY, CAL.—A. C. Musselman and D. A. Matheson, of Chico, have bonded the Richardson Springs property, and propose to install a small power plant using the water from the second falls at that place.

HUNTINGTON PARK, CAL.—Work will soon commence on the construction of plant of the Huntington Park Gas & Electric Company. Machinery has been purchased for the plant and contracts awarded for the work. The company was recently incorporated by E. M. De La Matyr, J. J. Curran and H. T. Leukfeld.

LOS ANGELES, CAL.—The Board of Public Works has awarded contracts for the lighting of Hill Street and Broadway during the next year. Electricity for the lamps on Broadway will be supplied by the Los Angeles Gas & Electric Company at 4¾ cents per kw-hour. The Pacific Light & Power Company will supply electricity for lighting Hill Street at the same price.

MONTEREY, CAL.—A new turbo-generator set of 500 horse-power has been installed in the power house of the Monterey County Gas & Electric Company to provide electrical energy for the street railway system of the company.

NAPA, CAL.—Plans are being made by the San Francisco, Vallejo & Napa Valley Railway Company to increase its service. It is proposed to purchase new cars and install new equipment in its power house, which will double the output of the plant.

NAPA, CAL.—The Pacific States Telegraph & Telephone Company has leased its local and rural lines at Calistoga to the Northwestern Electric Company, reserving the long-distance business. The latter company recently purchased the lines of the Calistoga & Clear Lake Telephone Company, which takes in all of the spring resorts in Lake County. The Pacific States company is making arrangements to improve its system in this city and has ordered a new $30,000 switchboard for the local exchange.

PLACERVILLE, CAL.—The Board of Trustees of this city has taken further steps toward the installation of a municipal electric lighting plant. Two propositions are being considered, one on River Hill and the other from Smith's Flat. The board will proceed at once to procure the services of an engineer and obtain estimates relative to the matter.

SAN BERNARDINO, CAL.—Work will soon begin on the construction of the new exchange building of the Pacific States Telephone & Telegraph Company, the cost of which is estimated at $12,000. The company has nearly completed the installation of its underground system, which will be put into service as soon as the new building is completed.

BUENA VISTA, COL.—The Town Board has granted a 20-year franchise to Buena Vista Smelting & Refining Company to construct and maintain an electric light and power plant in the town.

HARTFORD, CONN.—Bids for installing the lighting equipment for the Stone Bridge across the Connecticut River, at Hartford, will be received until March 17 by the Board of Commissioners of the Connecticut River Bridge and Highway District at its office, Aetna Life Insurance Building, Hartford, Conn. The contract will cover the complete installation of the lighting system for the four-light fixtures surrounding the trolley poles on the bridge. The fixtures, globes and lamps are not included in this proposal.

HOLLY OAK, DEL.—Plans are being made by the Holly Oak Public Service Association for lighting the streets of the town by electricity. There is no electric-light company in the town, but it is thought that some arrangement for a supply of electricity for lamps can be made.

WASHINGTON, D. C.—Bids will be received March 30 at the office of the Commissioners of District of Columbia, Washington, D. C., for furnishing metal cabinet work, electric lighting fixtures, electrical clock system and furniture and equipment for use in the new municipal building, Washington, D. C. Specifications, blank forms of proposals and all necessary information can be obtained at the office of the property clerk, District Columbia, District Building. Henry B. F. McFarland, Henry L. West and Jay J. Morrow are the commissioners.

WASHINGTON, D. C.—Bids will be received until March 25 at the office of the Superintendent of the U. S. Capitol Building and Grounds, Washington, D. C., for weather-proof and rubber-covered electric wire, switches, conduits, etc., for the office building, U. S. Senate, Washington, D. C. Material to be delivered at building; erection of the same not to be included. Specifications and schedule can be had upon application to the above office. Elliott Woods is Superintendent of U. S. Capitol Building and Grounds.

ALACHUA, FLA.—The city is contemplating the construction of an electric light plant and water works system.

SYLVESTER, GA.—An election will soon be held to vote on the proposition of issuing $10,000 electric light and water works bonds.

TENNILLE, GA.—Plans are being made to rebuild the municipal electric light plant at once, which was destroyed by fire on March 3.

NEZ PERCE, IDAHO.—The Nez Perce Co-operative Telephone Company has taken over the system of the Sunset Telephone Company, operating a line seven miles east of Nez Perce. The line will be extended this spring.

BELVIDERE, ILL.—The capital stock of the Boone County Rural Telephone Company has been increased from $2,500 to $20,000.

GALENA, ILL.—The City Council has instructed City Attorney Majors to draft an ordinance relative to the construction of an electric light plant to be owned by the city.

CHICAGO, ILL.—Plans have been prepared by C. B. Bride, of Spokane, Wash., for the development of 100,000 horse power on the St. Joe River in northern Idaho for the Chicago, Milwaukee & St. Paul Railway Company. The railway company is contemplating the installation of an electrical plant to furnish energy to operate its trains across the Bitter Root divide and to operate several sawmills and other manufacturing plants in St. Joe and St. Maries counties. It is said that the work can be completed in about three years, and will cost $3,000,000. A. J. Barling, of Chicago, is president.

PEORIA, ILL.—The City Council has passed an ordinance requiring the Peoria Street Railway to place its feed and transmission wires underground in the downtown district, the work to be completed by March 1, 1909.

PRAIRIETOWN, ILL.—A stock company has been formed by a number of farmers to build and operate a telephone system. Lines will be erected from Prairietown to Bunker Hill.

SPRING VALLEY, ILL.—The contract for lighting the streets of the city has been awarded to the Spring Valley Electric Light Company. The contract is for a term of 10 years.

TREMONT, ILL.—The Union Independent Telephone Company, of Augusta, Me., has purchased the plant and holdings of the Tazewell County Telephone Company, the consideration being $38,400. The first-named company had previously purchased the Tremont Independent Telephone Company, and it is understood that the two exchanges will be consolidated, and improvements and extensions made to the system.

GARRETT, IND.—The Garrett Telephone Company has filed an amendment to its articles of incorporation increasing its capital stock by $15,000. The company has taken over the exchange of the Central Union Telephone Company and will operate the local system. The Central Union company will retain the long-distance station.

MUNCIE, IND.—The Delaware & Madison Counties Telephone Company has decided to erect a new building in this city at a cost of about $25,000.

VINCENNES, IND.—It is reported that a deal has been closed by which the Vincennes Light & Power Company has become owner of the local interests of the Black Hawk Light, Heat & Power Company, which a few months ago brought natural gas to Vincennes from the Illinois field, a distance of 25 miles. This taking over will put an end to the rate war between the two companies.

FAYETTE, IA.—The Interstate State Telephone Company contemplates making extensions and improvements to the local exchange.

HAMPTON, IA.—The Central Telephone Company is planning to make improvements to the local exchange and also at Iowa Falls.

BARBOURSVILLE, KY.—The East Tennessee Telephone Company is making arrangements to extend its lines from Middlesboro to Barboursville, and contemplates installing exchanges at Pineville and Barboursville.

LEXINGTON, KY.—The East Tennessee Telephone Company is making a number of improvements to its system in this city and is contemplating the extension of its lines into the rural districts, which have not been previously entered. W. T. Haff is local manager.

WILLIAMSTOWN, KY.—The question of installing an electric light plant in the new roller mills is being considered. J. M. Riley is interested in the project.

HOUMA, LA.—The City Council is considering the question of establishing a municipal electric light plant and has appropriated $6,000 for the same.

MANSFIELD, LA.—It is reported that the municipal electric light plant will be taken over by a local company, which is being organized to purchase and operate the plant. L. G. Sample is interested in the project.

OPELOUSAS, LA.—The citizens are considering the question of enlarging the municipal electric light plant. A. C. Jones is superintendent.

GRAFTON, MASS.—The Grafton Electric Company has notified the town of Grafton that it can no longer furnish electric incandescent lamps to the town at $12 each per year. The company has submitted a proposition to the town offering to furnish incandescent lamps of 32 cp for a term of five years at $13.50 each per year, or at $14 per lamp per year on a one-year contract. There are 219 lamps now in use.

LENOXDALE, MASS.—Plans are being perfected for the organization of a local electric-lighting company to furnish electricity for commercial and street lighting. It is probable that electrical energy for operating will be secured from some other company.

NEW BEDFORD, MASS.—A number of merchants occupying stores on the square bounded by Union, William, Pleasant and Purchase Streets are interested in a project to establish an independent lighting plant to supply electricity for lighting their stores. Charles W. Clifford, Masonic Building, is interested in the enterprise.

NEW BEDFORD, MASS.—A special committee has been appointed by the City Council to investigate the question of municpal lighting. The committee consists of Aldermen Winspur and Washburn, Councilmen Livesey, Mahoney and McClure. W. H. Remington is clerk of the committee.

PALMER, MASS.—At the town meeting to be held March 23 the citizens will vote on the proposition as to whether or not the town shall acquire the franchise and property of the Central Massachusetts Electric Light Company. The company at present furnishes electricity for lighting in the towns of Palmer, Warren and Monson, and also energy for operating the Springfield & Eastern Street Railway Company.

ROCKPORT, MASS.—Robert Herne, chairman of the special committee appointed to investigate the question of municipal lighting on March 5, presented a supplementary report in which it was stated that to build and equip a municipal lighting plant for the town would cost $40,000, provided it could secure the overhead system of the Gloucester Electric Company at a reasonable price. Mr. Herne states that the value of the system is placed at $27,800 by the company, which he considers excessive. He presented figures tending to show that the plant would be a good investment for the town.

WESTMINSTER, MASS.—A committee has been chosen to confer with the Connecticut River Power Company in regard to its proposition to erect its transmission lines through the town to furnish electricity for lamps, motors, etc., and report at the next town meeting. The members of the committee are: J. C. Goodrich, Frank H. Battles, Dr. A. E. Mossman, Phillip H. Loughlin and D. W. Barnes.

CLINTON, MICH.—It is reported that improvements are to be made to the municipal electric light plant, including the installation of a new generator.

BAUDETTE, MINN.—A franchise has been granted to Stoner & Jewett, of Bemidji, granting them permission to erect and maintain an electric light plant in this town.

RICHVILLE, MINN.—A local telephone company has been formed and will install an exchange at once.

MOSS POINT, MISS.—It is reported that the L. A. Dantzler Lumber Company is contemplating the installation of an electric light plant.

PHILADELPHIA, MISS.—Plans are being prepared by the Philadelphia Compress Company for the erection of an electric-light plant.

ARCADIA, MO.—The construction of a concrete dam, 400 ft. long and 50 ft. wide, is being contemplated by Louis Miller and associates. It is proposed to develop 500 electrical horse-power. No machinery has yet been purchased.

CASSVILLE, MO.—The Cassville & Western Railway Company is contemplating the construction of an electric power plant. S. M. Mitchell is president and manager.

BILLINGS, MONT.—Arrangements are being made to extend the service of the Billings Mutual Telephone Company to all the farms and towns in the Stillwater and Rosebud valleys.

BUTTE, MONT.—A special meeting of the stockholders of the Butte Electric & Power Company will be held March 30 to vote upon the issue of $5,000,000 in bonds to be secured by the properties of the Butte Electric & Power Company and its subsidiaries, the Madison River Power Company and the Montana Power Transmission Company, the proceeds of which issue will be used to take up the floating debt of the companies and to provide them with additional working capital.

GLASGOW, MONT.—The city of Glasgow is contemplating the installation of water works, electric lighting system and making other improvements. H. C. Allen is city engineer.

HELENA, MONT.—We are informed that work will commence early this spring by the Capital City Power Company on the construction of a concrete-steel dam across the Missouri River near Helena, having a head of 120 ft. and 1500 ft. in length, which will develop 30,000 electrical hp, for transmission at 70,000 volts, three-phase to Helena, Butte and Anaconda. The contract for the construction of the dam has been awarded to the Capital City Improvement Company, of Helena, and includes the erection of a 70,000-volt transmission line, 40 miles in length. M. H. Gerry, Jr., is chief engineer and W. L. Miller engineer in charge.

WAHOO, NEB.—The City Council is considering the question of installing an electric-light plant and new water works for the city. An election will probably be held to vote on the proposition.

RENO, NEV.—It is stated that the Home Telephone Company is planning to enter this city, and that the company will operate in this state under the name of the Home Telephone Company of Nevada. The material for the construction of the lines has been ordered from the Sterling Electric Company, of Lafayette, Ind. The company proposes to connect all larger towns of Nevada, and also will connect with a line to Los Angeles. William La Shelles is interested in the enterprise.

TONOPAH, NEV.—The transmission line of the Nevada Power Company from Bishop to Millers is completed and the company will now furnish electricity direct for the Desert mill of the Tonopah Mining Company, as well as for the Belmont mill. It is expected that the transmission line will be extended to Manhattan and Round Mountain during the present year.

WINNEMUCCA, NEV.—The Utah-Nevada-Idaho Telephone Company has closed negotiations for the purchase of the Home Telephone Company, which is operating telephone systems in Winnemucca, Goldbanks, Paradise and Golconda. By this deal the company has secured telephone connection from Salt Lake City into all the important towns in eastern and southern Nevada. The company will begin construction of a number of lines which will eventually connect Winnemucca with San Francisco.

HAMPTON, N. H.—The Exeter, Hampton & Amesbury Street Railway Company was sold at public auction March 10 to Charles H. Penny, of Hartford, Conn., who represented a committee of bondholders of the company. The price paid for the road was $250,000.

PATERSON, N. J.—The Board of Freeholders of Passaic County has authorized County Counselor De Yoe to draft a bill to be introduced in the Legislature giving counties of this class the right to build their own lighting plants. The present contract between the county and the Public Service Corporation will expire in August, 1911. Under its terms the county pays at the rate of $140 per lamp per year, regardless of whether they are placed in outlying districts or in the heart of Paterson or Passaic.

ALAMAGORDA, N. M.—Plans are being prepared by Merrill H. Fisher for the construction of an electric power station.

ALBUQUERQUE, N. M.—The Colorado Telephone Company is making arrangements for the construction of a long-distance telephone line from Albuquerque to Estancia, where it will connect with the local and rural independent systems.

ALBANY, N. Y.—The City Council has passed an ordinance providing for 100 additional lamps for the city street-lighting system.

ALBION, N. Y.—Plans are being made by the Buffalo, Lockport & Rochester Railway Company to open the Rochester-Albion section on May 1. Electricity for operating the new road will be furnished by the Niagara, Lockport & Ontario Power Company from its transmission line running through Lockport. One connection will be made at Lockport and the other at South Greece.

BINGHAMTON, N. Y.—The Binghamton Electric Light, Heat & Power Company has nearly completed the installation of an additional 1000-hp equipment in its plant on Court Street, which will give a total output of 3000 horse-power.

CANISTEO, N. Y.—Plans are being considered by the business men of the town to purchase the telephone system of either the Century Telephone Company or the Bell Telephone Company, to be operated on the co-operative plan.

COEYMANS, N. Y.—The power house of the Atlantic Light & Power Company is rapidly nearing completion, the equipment of which consists of two 120-hp engines direct connected to alternating-current generators. The streets will be lighted with incandescent 40-cp lamps. There are 90 street lamps in Ravena, 55 in Coeymans and 40 in New Baltimore. The West Shore Railroad has contracted for 30 arc lamps for its yards in Ravena.

EAST WORCESTER, N. Y.—The Great Bear Light & Power Company has applied to the Public Service Commission for permission to exercise its franchises in East Worcester and Richmondville; also for permission to issue $20,000 in capital stock and $20,000 in bonds. The company has a water power plant in East Worcester, and proposes to furnish electricity in this town and in Richmondville for lamps, heat and motors.

ROCHESTER, N. Y.—Plans for the new telephone exchange building of the Bell Telephone Company have been filed, the cost of which is estimated at $16,000.

SPENCERPORT, N. Y.—The Ogden Telephone Company has decided to build its own system. The company has been negotiating with the Bell Telephone Company, with a view of buying its plant, but the two companies could not come to terms.

MINOT, N. D.—Arrangements are being made to erect a new power plant that will meet the needs of the entire city. It is proposed to organize a stock company to build the plant. J. A. Brunner is interested in the enterprise.

WILLISTON, N. D.—Arrangements are being made by the Muddy Valley Telephone Company to erect 22 miles of new line. G. W. Atterbury is secretary.

CEDARVILLE, OHIO.—Owing to the closing down of the electric light plant of the Cedarville Electric Light & Power Company, the City Council is considering the question of installing a new lighting system. The citizens recently voted in favor of issuing bonds for the construction of a municipal electric light plant.

CLEVELAND, OHIO.—The contract for constructing and equipping the railway of the Massillon, Wooster & Mansfield Traction Company has been awarded to the Mohawk Construction Company.

CLEVELAND, OHIO.—The City Council has transferred $37,000 from the general contingent fund of the city to the lighting fund, which will be used to purchase a 1000-kw unit, to be used in addition to the 500-kw machine now in operation in the municipal plant on the West Side. This additional equipment will give the plant sufficient output to light the streets in the territory west of the river, and, it is believed, will furnish sufficient energy to supply private service where desired.

CLEVELAND, OHIO.—Announcement has been made that arrangements have been completed for financing the construction of the Cleveland, Brooklyn & Elyria Railway Company and that work on the construction of that portion of the road between South Brooklyn and Orrville will be done this year. Next year the railway will be extended to Zanesville, with a branch from Strongville to Elyria. It is expected that the Westinghouse single-phase, alternating-current system will be used. According to the persent plans, the company will be absorbed by a new company, to be known as the Cleveland, Orrville, Coshocton, Zanesville & Elyria Railway Company, which will be capitalized at $4,800,000. The officers of the company are: W. E. Brooks, of Elyria, president; J. J. Breitlinger, of Cleveland, vice-president; J. H. Knisely, Jr., secretary, and B. E. Ottman, of Cleveland, treasurer.

COLUMBUS, OHIO.—The Board of Public Service has notified the finance committee of the City Council that it will submit an ordinance authorizing an issue of another $40,000 in bonds, the proceeds to be used to provide for additional equipment for the municipal electric-light plant, including additional lamps, coal-crusher outfit, rearrangement of the coal conveyor, installation of necessary meters and other apparatus.

CUYAHOGA FALLS, OHIO.—The question of increasing the equipment of the municipal lighting plant is under consideration by the City Council, and estimates of the cost of the new machinery have been submitted by the Arbuckle-Ryan Company. The plan is to double the output of the plant at once and, in the contract to be let, provide for the growth of the village for the next 15 years, which will probably require an expenditure of $10,000 at once and twice that amount within the period specified.

EAST PALESTINE, OHIO.—The capital stock of the Unity Township Telephone Company has been increased from $8,000 to $15,000. J. W. Hoon is secretary.

GALLIPOLIS, OHIO.—The directors of the Gallipolis Home Telephone Company contemplate enlarging the plant here. The capital stock of the company was recently increased from $50,000 to $100,000.

GIRARD, OHIO.—The question of establishing a municipal electric light plant and water works system is being considered by the citizens of this village. L. R. Bingham is interested in the project and would be glad to receive information pertaining to the construction of such a plant.

MOOREFIELD, OHIO.—The Moorefield & Cassville Telephone Company has filed an amendment to its charter increasing the capital stock of the company from $2,000 to $5,000.

PORT CLINTON, OHIO.—The capital stock of the Port Clinton Electric Light & Power Company has been increased from $15,000 to $25,000.

MANGUM, OKLA.—J. T. Patterson and J. W. Chambers, of Ada, have purchased the plant and holdings of the Mangum Electric Light & Power Company for $60,000.

PENDLETON, ORE.—The Eastern Oregon Independent Telephone Company has purchased the plant and holdings of the Butter Creek Telephone Company and is planning to make many improvements and extensions to the system. The capital stock of the company has been increased from $5,000 to $50,000, and the following named officers elected: O. F. Thomson, president; Asa B. Thompson, secretary and treasurer; W. W. Pankey, general manager.

PORTLAND, ORE.—The City Council has passed an ordinance directing the executive board to enter into a five-year contract with the Portland Railway & Light Company to furnish electricity for lighting the city.

TILLAMOOK, ORE.—Plans are being made for the construction of an electric light plant in this place. The cost of the plant is estimated at $15,000.

LEMOYNE, PA.—The system of the Valley Traction will soon be operated by electrical energy supplied by the York Haven Power Company. The power station at Lemoyne will be held in reserve for emergency purposes.

PITTSBURG, PA.—At the annual meeting of the Duquesne Light Company, held March 7, it was decided to proceed at once with the extension of its system, plans for which were adopted some time ago, but were delayed owing to the financial situation. The plans include the construction of a large power station to be located on the water front, and the present plant in East Liberty will be used as a substation. The cost of the new system is estimated at $4,000,000. George R. Webb, of Baltimore, Md., is president of the company.

NEWPORT, R. I.—The Board of Aldermen has instructed the city clerk to advertise for bids for lighting the streets of the city for periods of three and five years with electric, gas and vapor lamps. The present contracts have two months yet to run.

GREENVILLE, S. C.—Plans are being made by the Southern Power Company, of Charlotte, N. C., to extend its transmission lines into this city. Work will soon begin on the construction of the line and is to be completed by Sept. 1. Dr. W. Gill Wylie is president of the company.

KNOXVILLE, TENN.—The capital stock of the Acme Electric Company has been increased from $5,000 to $20,000.

NASHVILLE, TENN.—The City Council has granted the French Broad River Power Company a 45-year franchise to furnish electricity within the corporate limits of the city. The company proposes to erect a dam and hydro-electric plant at Pickle Island in the French Broad River for the purpose of generating electricity to be transmitted to Knoxville. Under the terms of the franchise, the plant must be in operation by March, 1912, and, upon the completion of the plant, pay the city $4,000 per annum for the first four years, and then $6,000 per annum until 1 per cent of the gross earnings in the city amount to $6,000 per year, when the company is to pay the city 1 per cent of its gross earnings in the city.

CHILDRESS, TEX.—A company has been organized in Childress to establish a light and power plant in this place. For further information, address C. W. Mitchell.

FORT WORTH, TEX.—It is reported that J. B. Wilbur, president of the Royal Trust Company, of Chicago, Ill., is interested in the construction of an electric light plant in Fort Worth.

GALVESTON, TEX.—Arrangements have been made for lighting the County Boulevard, by which it is understood that the county will erect the posts and wires and the city is to supply the lamps and maintain the system. The cost of the posts is estimated at $55 each.

HILLSBORO, TEX.—It is stated that plans have been completed by the Independent Telephone Company for the construction of a toll line from Amarillo to Fort Worth, and from Fort Worth to Hillsboro, with a branch line from Eagan to Cleburne. The lines will be built during the coming summer.

MEMPHIS, TEX.—Plans are being made by the Memphis Ice & Electric Company to install an electric light plant.

TAYLOR, TEX.—Owing to the dissatisfaction of the present rates charged for electric service, plans are being made for the construction of another electric light plant in Taylor. Local capitalists are interested, and it is said that the new company will fix the price of the service at 10 cents per kw-hour. The present rate is 20 cents per kw-hour.

DANVILLE, VA.—The Dan River Power & Manufacturing Company has increased its capital stock from $2,500,000 to $3,000,000. It is said that this action will not be followed by any further enlargements of the company's plant. The company's manufacturing plant is driven by electricity generated at a hydro-electric station.

PORTSMOUTH, VA.—The Southern Bell Telephone & Telegraph Company has purchased a site on Queen Street, on which it will build a new exchange building, the contract for which will be let in the near future. The building is to cost not less than $100,000.

NEWPORT, WASH.—R. S. Anderson, who was recently granted a franchise for a telephone system, has accepted the terms of the Council and will commence the construction of the system as soon as the weather will permit.

TACOMA, WASH.—Application has been made to the Commissioners of King County by Donald Fletcher, of Tacoma, for a franchise to erect transmission lines on the public road leading to Green River, Hot Springs. It is proposed to construct a large hydro-electric plant on the Cle Elum River about seven miles above the head of Lake Cle Elum. Applications have already been made for franchises in Pierce County.

ADAMSTOWN, W. VA.—The power plant of the Fairmont & Clarksburg Traction Company was damaged by fire recently, causing a loss of about $50,000. The plant will be rebuilt at once. The main office of the company is located at Fairmont.

KAUKAUNA, WIS.—Plans are being considered by the Fox River Valley Telephone & Telegraph Company to install a local exchange in this city, and also at Menasha and Neenah.

RANDOLPH, WIS.—A telephone company has been organized by the citizens living in and around Randolph for the purpose of erecting a telephone system to connect with the Wood County Telephone Company.

CHEYENNE, WYO.—The Northern Colorado Power Company has stopped work on improvements to its system in this city, owing to the

City Council having prohibited the company from carrying on further work in the city streets. The order resulted from the refusal of the company to accede to a demand from the Council, that it enter into an agreement to reduce the price of electricity for incandescent lamps from 20 cents to 12 cents per kw-hour, and the price for street arc lamps from $120 to $80 per year, and for electricity for motors 50 per cent, and also to reduce the price of gas 33⅓ per cent. The company offered to reduce the price to 15 cents per kw-hour for incandescent lamps, and for arc lamps to $100, but refused to make the reductions demanded by the Council.

LADYSMITH, B. C., CAN.—The Town Council has decided to make the necessary arrangements for the installation of an electric lighting system.

NEW WESTMINSTER, B. C., CAN.—On behalf of the Sunset Power Company, S. S. McDiarmid, of Vancouver, B. C., has made application in the Recorder's office here for 15,000 cubic inches of water from the Quanli River.

MINNEDOSA, MAN., CAN.—The citizens are considering the question of establishing an electric light plant in connection with the proposed municipal water works system.

ANCASTER, ONT., CAN.—The citizens of this town are interested in the organization of an independent telephone company. Henry Pim is one of the promoters.

BRACEBRIDGE, ONT., CAN.—Messrs. Hutchison, Smith and Thomson, of this town, are interested in the construction of a telephone line from Bracebridge to Port Carling and Minette.

GALT, ONT.—Chairman Fryer, of the Union of Western Municipalities, on the Niagara power question, states that the following municipalities have applied for power to the Hydro-Electric Commission: Galt, for 1200 horse-power; Guelph, for 2500 horse-power; Hamilton, municipal purposes only, 1500 horse-power; Woodstock, municipal purposes only, 900 horse-power; Preston, municipal purposes only, 600 horse-power; New Hamburg, municipal purposes only, 200 horse-power. Applications are now wanted from other municipalities as follows: London, Brantford, Stratford, St. Thomas, Waterloo and Hespeler. When these places have applied there will be a meeting of the executive union, at which contracts will be prepared and submitted to the municipal councils.

STEVENVILLE, ONT., CAN.—The Welland County Telephone Company is planning to remove its headquarters from Stevenville to Bridgeburg and will improve its system in that place, at a cost of $10,000.

MONTREAL, QUE., CAN.—The City Council is considering the question of establishing a municipal electric light plant, to cost $182,000. John R. Barlow is city engineer.

AMECA, MEX.—James P. Harvey, of Ameca, and associates are preparing to install a hydroelectric plant in that district to furnish electricity to operate the machinery of the mines and mills.

AMECAMECA, MEX.—The waterfalls of two branches of the Ayoloco River, near Amecameca, are to be utilized for a hydroelectric plant which Juan Falera and associates are preparing to install there. The electrical energy will be used for industrial purposes.

AUTLAN, MEX.—Thomas Kelly, of Chicago, Ill., and associates have planned to erect a hydroelectric plant on the Ojo Verde River, near Autlan, for the purpose of supplying the mines of that district with electricity.

GUADALUPE, MEX.—The Guadalupe de los Reyes Mining Company has installed a large electric plant in the Guadalupe de los Reyes camp, State of Sinaloa. The energy will be used to operate the mills and machinery for its mines.

GUANAJUATO, MEX.—A company, headed by Bernard MacDonald, of Guanajuato, one of the principal owners of the Guanajuato Consolidated Mining & Milling Company, has been formed and taken over the concession held by the Monterey Hydro-Electric Company for the installation of a large hydro-electric plant to supply Monterey with electricity. It is announced that 12,000 hp will be conveyed to that city by means of transmission lines from the plant that is to be erected on a river 50 miles distant from the town. The survey for the proposed plant has been made and all preliminary details for its erection arranged.

GUAYMAS, MEX.—Eugenio H. Gayou, of Guaymas, and associates have taken steps to erect a hydroelectric plant on the Guaymas Bay. Transmission lines will be built to Guaymas and other places where the electrical energy can be used.

HOSTOTIPAQUILLO, MEX.—C. H. Brooks, vice-president of the Santo Domingo Mining Company, of this place, is at the head of a syndicate of American and British capitalists who have taken steps to erect a hydroelectric plant on the San Diego River, in the State of Jalisco. The proposed plant will cost about $500,000 and will supply electrical energy to operate the mines of that district and adjacent territory. It is stated that the work of constructing the plant will soon begin.

MAZATLAN, MEX.—The city of Mazatlan is to be supplied with electricity for lamps and motors from a hydroelectric plant which Miguel Cordero and associates are arranging to install on the Presidio River.

MEXICO CITY, MEX.—Manuel Sanchez Navarro is constructing a large dam across the Lerma River in the State of Michoacan for the purpose of forming a storage reservoir, which will have a capacity of 100,000,000 cubic meters of water. The water will be used to operate a hydroelectric plant which he will install to supply mines and other industrial concerns with electricity.

MEXICO CITY, MEX.—Manuel Gomez Pezuela is preparing to fulfil the terms of a concession which he obtained recently from the Federal Government for the installation of a hydroelectric plant on the Amacusac River, State of Morelos.

ROSARIO, MEX.—The Tajo Mines Company is installing a large amount of electrical machinery and equipment at its mines in the Rosario district, State of Sinaloa.

TEMOSACHIC, MEX.—The Pinos Altos Mines Company has placed an order for machinery for an electric power plant and equipment for its mines and mill. Electricity will be transmitted about six miles to a substation, where a motor generator will be installed to change the energy from alternating current to a direct current for the operation of a 10-ton mining locomotive. Two 50-hp motors will be installed to operate the stamp mill, ore crushers, pumps and other machinery.

TEQUILA, MEX.—The Lerma Mines Development & Power Company is preparing to erect a large hydroelectric plant near the town of Tequila, State of Jalisco. The company will obtain its initial power from the Santiago River. According to the terms of the concession granted by the government, the company will transmit electricity to a number of mining camps in the State of Jalisco for the operation of mines and mills. The company has a capital stock of $1,000,000. Gill S. Peyton is president.

New Industrial Companies.

THE ELECTRIC-THERMO ALARM COMPANY, of Seattle, Wash., has been incorporated, with a capital stock of $250,000, by Watson James Hill and Frederick E. Kreatz.

THE SWEDISH ELECTRIC VIBRATOR COMPANY, of Chicago, Ill., has been incorporated by Foree Bain, George T. May, Jr., and C. A. Criswell. The company proposes to manufacture electrical apparatus.

THE ELECTRIC BELL & LOCK MAINTENANCE COMPANY, of Brooklyn, N. Y., has been incorporated, with a capital stock of $5,000, by Alvin Fuesslein, Henry Bonawitz and Frederick W. Barwick, all of Brooklyn.

THE MUTUAL TAXICAB COMPANY, of Hoboken, N. J., has been incorporated, with a capital stock of $125,000, to conduct a general electric cab service. The incorporators are: A. V. Jones, H. M. Browne and F. W. Mills, all of New York, N. Y.

THE FORT PITT MOTOR MANUFACTURING COMPANY, of Pittsburg, Pa., has been chartered, with a capital stock of $50,000, by Henry M. Schmitt, of Pittsburg, treasurer; Julius Sturtevant and George V. Rothweiler, of New Kensington.

THE EASTERN ELECTRIC COMPANY, of New Bedford, Mass., has filed a certificate of incorporation, with a capital stock of $15,000. The company proposes to manufacture and deal in electrical appliances. Edward H. Jennings is president and treasurer.

THE ELECTRIC RAILWAY TRAINING COMPANY ASSOCIATION, of Kansas City, Mo., has filed articles of incorporation, with a capital stock of $12,000. The incorporators are Frank M. Robinson, Albert F. Drake, Arthur P. Keel, Herman F. Cook and Norman E. Newman.

THE SOVEREIGN ELECTRIC MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $150,000. The company proposes to manufacture lighting appliances and fixtures. The incorporators are L. O. Hall, E. E. Hall and L. P. Smith, of New York City.

THE STERLING ALTERNATING IGNITION COMPANY, of Binghamton, N. Y., has been incorporated, with a capital stock of $25,000, to manufacture machinery and its appliances. The incorporators are: Howard L. Loper, of Richmond Hill; A. R. Kelly and Fred Knowlton, of New York, N. Y.

THE ELECTRO-WELD COMPANY, of Marlboro, Mass., has been incorporated, with a capital stock of $30,000. The directors are: Frank Billings, president; Hector E. Moineau, treasurer, and Daniel F. Hayward. The company proposes to manufacture and deal in articles of steel and iron, etc.

FEDERAL TAXICAB COMPANY, of Jersey City, N. J., has been incorporated, with a capital stock of $200,000, to manufacture motors, engines, machines and cars for the transportation of passengers, goods, etc. The incorporators are: Edward McM. Mills, Richard F. Tully and Cornelius A. Cole.

THE HACHENBERG TURBINE COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $250,000. The incorporators are: L. Sandford, of Yonkers; L. Hachenberg, of New York City. The company proposes to manufacture engines, boilers, machinery, motors, etc.

THE JUST-RIGHT-LIGHT COMPANY, of Wakarusa, Ind., has filed articles of incorporation with the Secretary of State. The capital stock is placed at $10,000. The object of the corporation is to manufacture light, heat and electrical apparatus. R. E. Myers, Jacob Helmkee and W. O. Yarian are the directors.

THE NATIONAL TELEPHONE RECORDER COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $10,000. The incorporators are Jacques Rieser, Herman M. Braun and Lawrence Goldman, all of New York. The company proposes to manufacture the Gamble telephone recorder.

THE ELECTRO MAGNETIC APPLIANCE COMPANY, of Hammond, Ind., has been incorporated, with a capital stock of $25,000, for the purpose of manufacturing an electric riveting hammer invented by John Rathburn, of Hammond. The officers of the new company are: C. G. Kingwell, president; C. E. Bauer, vice-president and treasurer, and J. B. Rathburn, secretary and electrical engineer.

Company Elections.

COLUSA, CAL.—At the annual meeting of the Glenn County Telephone Company H. J. Barceloux was elected president and George Barceloux secretary and treasurer.

SAUNEMIN, ILL.—At the annual meeting of the Saunemin Mutual Telephone Company the following named officers were elected: Dr. C. F. Ross, president; W. F. Shepherd, secretary, and H. G. Norman, treasurer.

JESUP, IA.—At the annual meeting of the Farmers' Mutual Telephone Company the following named officers were elected: J. T. Burrell, president; W. C. Kenney, vice-president; C. L. Bright, secretary, and James Tracy, treasurer.

LE CLAIRE, IA.—At the annual meeting of the Le Claire Independent Telephone Company the following named officers were elected: Henderson Graham, president; J. P. Suiter, vice-president; Arthur Dawley, secretary, and William Henry, treasurer.

JEFFERSONVILLE, KY.—At the annual meeting of the Laurel Telephone Company the following-named officers were elected: Perry Spurgeon, president; R. M. Martin, vice-president, and John Hallett, secretary and treasurer.

BENDON, MICH.—At the annual meeting of the Farmers' Telephone Company the following named officers were elected: William Dexter, president; J. W. Jarrett, vice-president; S. D. Burke, secretary; A. Allen, treasurer, and Hector McLean, manager.

REDWOOD FALLS, MINN.—At the annual meeting of the Redwood County Telephone Company A. O. Gimmestad, of Bellview, was re-elected director, and also was elected president of the company. A. G. Weldon, of Wabasso, and R. A. Maahs, of Echo, and L. Lindeman, of Renville, were also elected directors.

LACONIA, N. H.—At the annual meeting of the Laconia Electric Lighting Company the following named officers were elected: W. L. Maurin, of Providence, R. I., president; J. P. Maurin, of Providence, R. I., vice-president; Thomas E. Stere, of Providence, R. I., treasurer; F. M. Beckwith, of Laconia, clerk, and F. L. Thomas, of Laconia, manager.

OBERON, N. D.—At the annual meeting of the local telephone company the following named officers were elected: Charles Schaffner, president; E. A. Hatch, vice-president; A. Baldwin, secretary and treasurer.

MARTINSBURG, OHIO.—At the annual meeting of the Knox-Licking Telephone Company the following-named officers were elected: A. O. McKee, president; Solon Ackley, vice-president; F. E. Elliot, secretary and manager, and J. N. Frees, treasurer.

PHILLIPSBURG, PA.—At the annual meeting of the United Home Telephone Company the following-named officers were elected: S. A. Blessing, of West Milton, president; N. W. Rinehart, vice-president; T. B. Mills, of Brookville, secretary; H. B. Marshall, of Brookville, treasurer, and S. A. Mosby, of Phillipsburg, manager.

PITTSBURG, PA.—At the annual meeting of the Duquesne Light Company the following-named officers were elected: George R. Webb, of Baltimore, Md., president; D. P. Reighard, vice-president; S. P. Austin, secretary, and Robert C. Hall, treasurer.

FORT WORTH, TEX.—At the annual meeting of the Northern Texas Traction Company the following-named officers were elected: Guy E. Tripp, president; John T. Hallowell, first vice-president; H. T. Edgar, second vice-president and manager; Alvah K. Todd, secretary; Henry B. Sawyer, treasurer, and Charles E. Aldrich, assistant secretary.

ARKANSAW, WIS.—At the annual meeting of the Farmers' Telephone Company the following-named officers were elected: B. M. Catura, president; James Black, vice-president; Peter Taylor, treasurer, and Fred Pitman, secretary.

GILMANTON, WIS.—At the annual meeting of the Gilmanton & Dovers Farmers' Telephone Company the following-named officers were elected: E. F. Turner, president; S. Glauzmann, vice-president; C. J. Sund, secretary, and A. B. Hutchinson, treasurer.

New Incorporations.

PETALUMA, CAL.—Articles of incorporation have been filed for the Central Telephone & Telegraph Company. The incorporators are: John H. Dickinson, E. A. Nordyke and J. H. Stone.

SANTA ROSA, CAL.—The Central Telephone & Telegraph Company has been incorporated by J. H. Dickinson, E. A. Nordyke and J. H. Stone.

SANTA ROSA, CAL.—The Chilens Valley Telephone Company has been incorporated, with a capital stock of $5,000, by M. de Martin, Charles Martin, A. Bloom, H. Juhl and J. Schobeda.

HASTY, COL.—The Union Telephone Company has been incorporated, with a capital stock of $10,000, by W. A. Hasty, George A. Johnson, C. E. Liggets, A. B. Ham and B. A. Wilson, all of Hasty.

DALTON, GA.—The Dogwood Telephone Company has applied for a charter. The capital stock of the company is placed at $1,000 with the privilege to increase it to $10,000. The incorporators are G. W. Head and J. C. Keown.

EVANSVILLE, IND.—The Evansville Terminal Railway Company has been incorporated, with a capital stock of $200,000, by Albert F. Karges, Marcus Sontag, William H. McCurdy, James V. Rush and others. The purpose of the company is to promote, construct and operate street and interurban railways and to operate plants for the distribution of electricity for lamps and motors, etc.

OLIO, IND.—Articles of incorporation have been filed for the Olio Telephone Company with the Secretary of State by B. R. Smith, S. R. Williams and F. F. Johnson. The company proposes to build and operate a telephone system in this town and in the eastern portion of Hamilton County.

JEFFERSON, IA.—The Jefferson Township Telephone Company has been incorporated and will erect 40 miles of wire by early spring.

LAKIN, KAN.—The organization of the Kearny County Mutual Telephone Company has been perfected and the following named officers elected: W. S. Prather, president; A. R. Hetzer, vice-president; Thomas Prather, secretary, and Mrs. A. J. Smith, treasurer. Work on the construction of the system will begin about April 1.

TOPEKA, KAN.—The Kansas City & Kansas Southwestern Railroad Company has been organized, with a capital stock of $10,000,000, by E. M. Lambkin, of Kansas City; C. S. Dudley, Minneapolis, Minn.; S. W. Brewster, Chanute; H. E. Hopper, of Indianapolis, Ind.; J. E. Martin, of Minneapolis, Minn., and W. L. Moyer, of New York, N. Y.

BALTIMORE, MD.—Application has been made to the State Legislature for the incorporation of the Baltimore Light, Heat & Power Company. The capital stock of the company is placed at $100,000, with the privilege of increasing it to $2,500,000. The company proposes to furnish electricty for lighting, in conjunction with the steam heating, refrigerating and cold storage business. It is also understood that the company proposes to secure electricity from the plant of the Patapsco Electric Manufacturing Company on the Patapsco River. The incorporators are: Richard B. Fentress, president of the Baltimore Refrigerating & Heating Company; John W. Van Dyke, of Pennsylvania; Arthur Montell, John A. Tompkins and George E. Taylor, of Maryland.

LAKELAND, MINN.—The St. Croix Rural Telephone Company has been organized and the following named officers elected: Andrew Anderson, president; Samuel McKean, vice-president; John M. Oliver, secretary and treasurer.

PURDY, MO.—The Purdy Telephone Company has filed articles of incorporation, with a capital stock of $5,000. The incorporators are R. C. Overton, James M. Bayless, A. C. Garrison and others.

ST. JAMES, MO.—Articles of incorporation have been filed with the Secretary of State for the St. James Ice & Power Company. The company is capitalized at $25,000, and the incorporators are Chris. Koeln, of St. Clair; Louis Becker, L. B. Carroll and Edward W. Floristel, all of St. Louis. The company proposes to produce electricity and gas for light, heat and power, and to manufacture ice and do a cold storage business, etc.

JERSEY CITY, N. J.—The Mutual Benefit Electric Light & Power Company has been incorporated, with a capital stock of $2,500,000, for the purpose of producing and distributing electricity for lamps, heat and motors. The incorporators are: J. R. Blinck, R. S. Carrick, J. F. Nagle, of Jersey City, and J. M. Seymour, Jr., of Newark.

REMSEN, N. Y.—A rural telephone company has been organized in East Remsen to construct a line from Lake Julia to Remsen. The officers of the company are: R. R. Pritchard, president; William H. Thomas, vice-president; N. C. Phelps, secretary, and David R. Jones, general manager.

BRINSMADE, N. D.—The Brinsmade Telephone Company has filed articles of incorporation, with a capital stock of $2,000. The incorporators are S. M. Gibbs, Alexander Link and C. M. Muri, all of Brinsmade.

CARPIO, N. D.—The Carpio Telephone Company has been incorporated, with a capital stock of $10,000, by George A. Dahle, G. K. Christianson, Bisgard Kappel and others, all of Carpio.

OKARCHE, OKLA.—The Straight West Telephone Company has been incorporated, with a capital stock of $500, by George Hufnazel, H. Louis, all of Okarche.

SENTINEL, OKLA.—Articles of incorporation have been filed for the Sentinel Long-Distance Rural Telephone Company. The company is capitalized at $10,000, and the incorporators are: M. Wright, F. Wingham, of Sentinel; W. H. Davis and C. C. Allen, of Rocky.

JACKSONVILLE, ORE.—The Oregon Rapid Transit & Power Company has filed articles of incorporation, with a capital stock of $3,000,000. The purpose of the company is to construct and operate an electric railway throughout Rogue Valley. The present plans contemplate the construction of a railway from Ashland to Grants Pass. The incorporators are : J. E. Watt, F. E. Merrick, F. E. Page, A. S. Bliton, S. A. Nye and F. L. Evans.

TILLAMOOK, ORE.—The Tillamook Electric Light & Fuel Company has been incorporated, with a capital stock of $15,000, by Charles I. Clough, A. K. Case and Henry Crenshaw.

McADOO, PA.—The McAdoo Electric Company has been incorporated, with a capital stock of $10,000. A. W. Drake, of Lattimer Mines, is treasurer, and the directors are: John S. Wise, of Lattimer Mines; L. O. Emmerick, Nicholas Kuech, of Hazleton; Thomas L. Kearns and Peter McCarron, of McAdoo.

PITTSBURG, PA.—The Pennsylvania Electric Company has been incorporated, with a capital stock of $10,000, by L. L. Banks, James Bradley, J. L. Merrill, J. W. Boileau and S. Sellers, all of Pittsburg.

PITTSBURG, PA.—The Central Light, Heat & Power Company has been chartered with a capital stock of $10,000. J. T. Crump is treasurer, and the directors are T. J. Crump, H. F. Steele, H. Tucker, all of Pittsburg.

REIGELSVILLE, PA.—The Clymer Power Company has been incorporated, with a capital stock of $60,000, by Lee S. Clymer, of Reigelsville, treasurer; Benjamin F. Fackenstal, Jr., of Reigelsville, and John S. Fackenstal, of Easton.

SWISSVALE, PA.—A charter has been granted to the Empire Machine & Electric Company. with a capital stock of $10,000. E. Ernest Rose, of Swissvale, is treasurer, and the directors are James R. Bell and Benjamin H. Thompson, of Pittsburg.

BATSON, TEX.—The Independence Telephone Company, of Batson, has been organized for the purpose of constructing a telephone line from Batson to Hardin.

TAYLOR, TEX.—The Citizens' Light & Power Company has been incorporated, with a capital stock of $10,000, by Howard Bland, E. A. Robertson, T. W. Marse, H. D. Mendell and C. B. Challeber.

MANGOHICK, VA.—The King William Telephone Company has been granted a charter, with a capital stock of $3,000. The officers of the company are: W. T. Mooklar, president; H. B. Smith, Jr., vice-president; J. T. Mitchell, secretary, and C. J. Powell, treasurer.

ELKINS, W. VA.—The Roaring Creek Power Company has been chartered, with a capital stock of $25,000, by P. B. Bloomfield, C. W. Maxwell, of Elkins; W. S. Walker, of Ligonier, Pa.; M. J. Brown, of Frostburg, Md., and J. E. Morgan, of Elkins.

BENTON, WASH.—The Benton Independent Telephone Company has been chartered, with a capital stock of $4,800, by Clark E. DeBow, James M. Hobland, Frank P. Jackson and others.

WASHOUGAL, WASH.—The Home Telephone Company has filed articles of incorporation with the Secretary of State. The company is capitalized at $1,000; the incorporators are G. M. Keep, Morris Webber and A. J. Henrickson.

YAKIMA, WASH.—Articles of incorporation have been filed with the Secretary of State for the Sunnyside Telephone Company, with a capital stock of $15,000, by J. J. Brown, Emery Thompson, George E. Rodman, F. J. Taylor and S. T. Woodlin.

SHEBOYGAN FALLS, WIS.—The Sheboygan Falls Light & Power Company has been incorporated, with a capital stock of $25,000, by Otto B. Weisse, Emil Weisse and others.

SPOONER, WIS.—Articles of incorporation have been filed for the Burnett & Washburn County Telephone Company, with a capital stock of $4,000, by C. L. Klinzman, and others.

FORT WILLIAM, ONT., CAN.—The Iron Range Railroad & Development Company will apply to the Provincial Legislature for incorporation and other things, ask for power to build and maintain telephone and telegraph lines, also electric power plants. For further information address J. F. Swinburn, Fort William, Ont.

LOWVILLE, ONT., CAN.—The Nelson Telephone Company has been incorporated, with a capital stock of $10,000, by James Jardin, J. H. Hilliken, J. W. Cust and George Ramshaw.

PILOT BUTTE, SASK., CAN.—The Canadian-American Telephone Company has been organized, with the following officers: E. Raffenberg, president; B. Holden, vice-president; G. Moore, secretary; George Anderson, treasurer, and W. Keay, general manager.

MEXICO CITY, MEX.—A British company, capitalized at $1,000,000, is being formed here to establish an extensive system of long-distance and local telephone lines in southern Mexico. It is stated that the company will operate under a concession which Manuel S. de Corbera and J. Sitzenstatter, of this city, obtained from the federal government for a long-distance line between this city and Vera Cruz. The company will establish exchanges in the cities of Vera Cruz, Cordova, Orizaba and other places. The concession also gives the right to establish wireless telephone stations throughout the territory in which they are to operate. Messrs. Corbera and Sitzenstatter are now constructing an underground system in Vera Cruz, and more than three miles of conduits have been laid.

MORELIA, MEX.—A local telephone company has been formed in this place with the following officers: Jose Oseguera, president; Manuel D. Bonilla, vice-president; Rafael Elizarrarras, secretary, and Manuel Garcia Gomez, treasurer. The company will establish a telephone in this city and adjoining towns.

Legal.

CRAWFORDSVILLE, IND.—By virtue of a decree of the Federal Court, in the interest of the Knickerbocker Trust Company, of New York, Edward Daniels, of Indianapolis, Master in Chancery, will conduct the sale of the plant of the Crawfordsville Water & Light Company. No bid will be accepted for less than $75,000.

BATTLE CREEK POWER COMPANY.—The suit of the Battle Creek Power Company, of Redding, Cal., against the Pacific Power Company and others to condemn 12 acres of land on Battle Creek for a reservoir site has been ended, the jury giving the Battle Creek company the land sought, but requiring $32,500 as damages. The land is worthless except for the water rights going with it. The Battle Creek company's right to 18,000 in. of water was confirmed.

SANTA CRUZ ELECTRIC COMPANY.—The jury in a $20,000 damage suit brought by R. C. Muburtis against the Santa Cruz Electric Light Company, of Santa Cruz, Cal., has brought in a verdict for the defendant. Mr. Muburtis claimed that he had been knocked from the top of a Southern Pacific Company's box car by a wire that was allowed to sag over the railroad company's track, and that, in addition to the injuries sustained by the fall, he received an electric shock and burns that have impaired his health. The defence claimed that Muburtis should have brought his suit against the railroad company, as the track at that point had been changed from a narrow to a wide gauge track, thereby allowing the passage of taller cars, which was the real cause of the trouble.

INJURY TO LINEMAN BY CONTACT WITH ELECTRIC LIGHT WIRES.—In the recent case of Grimm vs. Omaha Electric Light & Power Company, Supreme Court of Nebraska, 114 N. W. Rep., 769, it is held that the instinct of self-preservation and the disposition of men to avoid personal harm may, in the absence of contrary evidence, raise the presumption that a lineman, killed or injured while engaged in locating and remedying trouble on the lines, was in the exercise of ordinary care. It was further held that the burden of establishing that the lineman had assumed the risk of the dangers connected with his employment was upon the electric light company. In the case of Bell Telephone Company vs Detharding, 148 Fed., 371; 78 C. C. A., 185, plaintiff's intestate was employed by defendant telephone company as a "trouble finder" and was sent by his superior in the line of his duty to ascertain the cause of the failure of a telephone to work properly, which was unknown. In climbing a cable pole his hand came in contact with a guy wire, from which he received an electric shock, which caused him to fall, and he was killed. From the effects of a storm of the previous night, or from some other cause not shown, the telephone wires leading to the pole had sagged across electric light wires and had also charged the guy wire. Held, that the risk from such danger was one known to and assumed by plaintiff's intestate as one necessarily incidental to his employment, and that there could be no recovery from defendant for his death.

CONSUMER NOT BOUND TO PAY FOR ELECTRIC CURRENT AS REGISTERED BY DEFECTIVE METER.—The defendant, a manufacturing company engaged in repair work, entered into a contract with the plaintiff, a quasi-public corporation engaged in selling electric current for light and power, in which contract the defendant agreed to pay for the electric current furnished by the plaintiff "at the rate of ten (10) cents for each horse-power hour, as measured at and by the meter provided by the (plaintiff) company." The defendant used the current and paid the monthly bills rendered therefor for a period of three years, when, on Aug. 20, 1904, the plaintiff discovered that an error had been made in each of the previous monthly readings by the various inspectors of the plaintiff, who, having omitted a cipher in the reading of the units, had during this entire period been rendering bills which, it is claimed, gave only about one-tenth of the current used by the defendant in this time. The plaintiff, relying on the words of the contract, presented an additional charge for $3,828.36, or for $1,650 a year, as against the annual charge of $350, which the plaintiff had paid. The defendant for several months paid the bills made in accordance with this new reading of the meter, but he refused to pay the amount claimed by the plaintiff as due before the discovery of the error. Though the court admitted the evidence of the defendant, which showed that the plaintiff's meter was inaccurate and that the new reading of the current was altogether disproportionate to the horse-power employed; and though the plaintff's witnesses testified that they had been accustomed to read the meter improperly, and that such meter had never during the period in controversy been properly tested, and that when finally tested it was found to be 13 per cent fast, yet a verdict was directed for the plaintiff for the full amount, with interest. On appeal it was held that the defendant was not liable for the amount registered in the meter, but only for the current actually used. To enforce the contract literally would have worked a manifest injustice, for if the consumer were liable absolutely according to the amount of electricity registered by the meter, there would be no redress if an inaccurate meter should register a consumption calling for an impossible payment.—(New York & Queens Electric Light & Power Co. vs. Long Island Machine & Marine Construction Company, New York Appellate Division, 100 N. Y. Supp., 176.)

Personal.

MR. F. C. FINKLE, consulting engineer of Los Angeles, Cal., announces the removal of his office from the Edison Building to Rooms 230-231, I. W. Hellman Building, of that city.

MR. JOSEPH B. McCALL, president of the Philadelphia Electric Company, has been put forward as a candidate for delegate from Philadelphia to the coming national Republican convention.

MR. WILLIAM E. FOSS, of Boston, has been retained by the Newark (N. J.) Board of Public Works to make an investigation of the electrolytic effect of trolley currents on the water mains of that city.

MR. GEORGE R. WEBB, formerly president of the Maryland Telephone Company, of Baltimore, Md., has been appointed president of the Duquesne Light Company, Pittsburg, Pa., to succeed Mr. Robert C. Hall.

MR. ARTHUR L. MUDGE, who for the past four years has been associated with the Allis-Chalmers Company and with Allis-Chalmers-Bullock, Limited, has recently joined the staff of the Canadian Crocker-Wheeler Company, Limited, Montreal.

MR. H. L. DOHERTY, who is president of the holding company that controls the Rockford, Ill., Edison Company, is to address the members of the Rockford Manufacturers & Shippers' Association at their annual business meeting to be held March 21.

PROF. J. J. GREEN, formerly in charge of the electrical engineering department of Notre Dame University, has gone abroad to make a tour of the more notable electrical plants of Europe, and for attendance at the Marseilles International Electrical Exposition.

MR. THOMAS B. PECK, JR., sales manager for some time past for the Electro-Dynamic Company, of Bayonne, N. J., manufacturers of interpole motors, etc., has resigned that position, and is now taking a vacation in the South. His successor has not been announced.

MR. JOHN W. BRASHEARS, who for many years has been first assistant to W. A. Converse, chemical director of the Dearborn Drug & Chemical Works, in charge of the Analytical Laboratories, has been appointed assistant superintendent of the manufacturing department.

MR. R. S. STANGLAND has assumed charge of Muralt & Company's construction office at New Fort Lyon, Col., and will superintend the erection of the complete lighting, heating and power plant which his firm is building for the United States Government at the Naval Hospital at that place.

MR. FRANK F. FOWLE has taken offices in Marquette Building, Chicago, for practice as a consulting engineer. Mr. Fowle will make a specialty of work connected with the design and construction of telephone systems, including railway telephone systems, and also of alternating-current engineering.

MR. T. A. EDISON has so far recovered from the recent operation for mastoiditis and aural abscesses that he was able to leave on Saturday last for his Florida place at Fort Myers. He was accompanied by Mrs. Edison, and they traveled in a private car. Mr. Edison will remain in Florida for several weeks.

MR. ARTHUR L. LINN has been appointed general auditor of the Schenectady Railway Company, which places him in charge of the accounting of all of the railway and lighting companies in which the Mohawk Valley Company is interested. In addition, he is either the secretary or assistant secretary of fifteen of the nineteen companies. Mr. Linn's office is located in the Night & Day Bank Building, New York City, where he makes his headquarters.

MR. W. A. LAYMAN, general manager of the Wagner Electric Manufacturing Company, of St. Louis, has recently been elected a vice-president of that company. Mr. Layman has risen very rapidly through various positions in this company, and under his management a large factory has been erected. His election to the vice-presidency is an evidence of the appreciation of his business and engineering judgment and ability, which his friends are glad to see thus recognized.

MR. HAROLD BUTTENHEIM has resigned as business manager of *Street Railway Journal* and as secretary of the McGraw Publishing Company, in order to devote himself to the conduct of *Hardware*, the semi-monthly representative of the hardware trade, in which he has purchased the controlling interest. Mr. Buttenheim became connected with the *Street Railway Journal* in 1893, and since then merit and hard work had won for him successive and rapid promotions. He takes with him the hearty good will and best wishes of his former associates. The headquarters of Mr. Buttenheim's new company, incorporated this week under the name of The Hardware Press, will be at 114 Laberty Street, New York.

MR. E. N. SAWTELLE, who has for some years been the London district manager of the British Westinghouse Electric & Manufacturing Company, with headquarters in the Westinghouse Building, Norfolk Street, Strand, London, has been recently promoted to the position of territorial sales manager. Mr. Sawtelle, who is as well known in the United States as he is in England, having for many years been connected with the Westinghouse interests, both in Cleveland and New York, now makes his headquarters at the company's works in Trafford Park, Manchester, where he will co-operate with the district office managers in the further development of their territories, and will, in addition, take personal charge of such more important negotiations as he may be directly interested in. Mr. O. H. Baldwin, who is also well known in the United States but better known in England for the past ten or fifteen years, has been appointed the manager of the London district.

Obituary.

MR. FRED BRYSON MAZE, an electrical engineer connected with the General Electric Company at Schenectady, N. Y., died March 8, aged 30 years.

MR. ADDISON F. HUNTIE, secretary and treasurer of the United Illuminating Company of Connecticut, New Haven, Conn., died suddenly March 13 at his home in New Haven. He was 40 years of age. A widow and three children survive him.

MR. JOHN BURRY, electrical engineer of the Stock Quotation Telegraph Company and inventor of the Burry printing telegraph system, died suddenly last week at the age of 47 years. Mr. Burry was born in Fribourg, Switzerland, and came to this country when 19 years old. As noted in a recent issue, the Burry printing telegraph is now being tried for use in communicating the course of proceedings on the floor of the House of Representatives in Washington, to committee rooms and the offices of members.

MR. ALBERT ANDERSON.—We regret to announce the death of Mr. Albert Anderson, president of the Albert & J. M. Anderson Manufacturing Company, of Boston, which occurred on Wednesday, March 11. Mr. Anderson was born near Christiania, Norway, June 26, 1850. At the age of 16 he left home, and after following the sea for about five years settled in Boston, in 1871. In 1877 he started a small machine shop in Washington Street, and the business grew so rapidly that not long after a second shop on Hamilton Street was opened. The present factory site was occupied in 1888, about which time Mr. Anderson began to devote his attention to the electrical field, starting the manufacture of trolley line and station material. He constantly added improvements to his line of manufactures, some of which were covered with patents. In the summer of 1906 Mr. Anderson received a severe shock from coming in contact with a 6900-volt circuit, and his health never recovered from the effects. Mr. Anderson is survived by his brother, Mr. John M. Anderson, a daughter and two sons—Mr. Albert B. Anderson and Mr. Andreas Anderson—who will become partners in the company, succeeding their father.

Unclassified Items.

COLUMBUS, NEB.—The Columbus Light, Heat & Power Company has been incorporated with a capital stock of $150,000, by William C. Rose, John L. Burke and John W. Parrish.

NEWARK, DEL.—The Elk River Heat, Light & Power Company has filed articles of incorporation with a capital stock of $100,000. The incorporators are S. M. Donnell, of Newark; E. W. Maloney, of Avondale, Pa., and B. F. Groff, of Lancaster, Pa.

MR. GEORGE A. CAMPBELL, for the past two years manager of the Reno Power, Light & Power Company, of Reno, Nev., has resigned to accept a position as general superintendent of the Truckee River General Electric Company, operating plants at Carson, Virginia, Yerington, Gardinerville, Reno and other places in Nevada.

MR. E. W. CLARK has been appointed superintendent of the municipal electric light plant at Ellensburg, Wash., to succeed Mr. W. L. Leverich, resigned.

ELMIRA, N. Y.—The Public Service Commission, second district, has authorized the Elmira Water, Light & Railroad Company to issue its bonds to the amount of $372,000, to be sold at not less than 80 per cent of their par value, the issue of the capital stock to be secured by such issue being required for the refunding of certain of its obligations and for the completion, extension and improvement of its plant.

LEESBURG, GA.—Preparations are being made by the citizens to erect a complete telephone system for the town, which is to be in operation within 60 days.

COVINGTON, KY.—At the annual meeting of the Cincinnati, Newport & Covington Light & Traction Company the following directors were elected: C. M. Thurnauer, J. C. Ernst, Julius Fleischmann, J. M. Hutton, J. S. Trevor, Randolph Rodman, R. W. Neff, C. P. Garney and T. S. Hamilton.

NEWARK, N. J.—At the annual meeting of the United Electric Company the following-named directors were elected: John J. Burleigh, Walton Clark, Mark T. Cox, Anthony R. Kuser, Lewis Lillie, Thomas N. McCarter, U. H. McCarter and George J. Roberts.

PRINCETON, ONT., CAN.—At the annual meeting of the Princeton-Drumbo Telephone Company the following-named officers were elected: F. J. Daniel, of Princeton, president; T. Convay, vice-president, and Thomas Starr, secretary and treasurer.

NAPOLEON, OHIO.—At the annual meeting of the Okolona Telephone Company the following-named officers were elected: Fred Gunn, president; D. Panning, vice-president; J. A. Benien, secretary, and G. H. Freytag, treasurer.

RUSHFORD, MINN.—The City Council has granted the City & Farmers' Telephone Company a franchise to erect a telephone exchange in this city.

WILDWOOD, PA.—The City Council has granted the Eastern Telephone & Telegraph Company a franchise to install complete telephone and telegraph systems in the city.

NEWPORT, KY.—The Water Works Commissioners have instructed Superintendent Glazier to prepare plans and specifications for the construction of an electric light plant to be installed at the pumping station.

CHILTON, WIS.—Application has been made to the City Council for a franchise for an electric light plant in this city.

HARTFORD CITY, IND.—The Hartford City Electric Light Company contemplates making improvements to its plant and will install additional machinery.

TRENTON, MO.—The Board of Public Works is considering the question of establishing a municipal electric light plant. For further information address C. A. Foster.

HOLYOKE, MASS.—The Walsh Holyoke Steam Boiler Works has been awarded the contract for furnishing and installing the new steel penstock, with its branches for the electrical power station of the Newfoundland Development Company, at Grand Falls, N. F. The contracts amount to $210,000.

MYRTLE POINT, ORE.—Plans have been completed by the Coquille Valley Power Company for the construction of a power plant at the head of Brewster Valley, which will have a minimum output of 4000 horsepower. The water will be flumed for a distance of 5000 feet and will have a fall of 300 feet through a pipe line to the power house. Electricity will be transmitted to Myrtle Point, Coquille, Marshfield, North Bend and Bandon. Two hydro-electric units and two steam-driven units will be installed. J. S. N. Smith, of Ashland, consulting engineer, has charge of construction of the plant.

OLYMPIA, WASH.—J. H. Swift has filed a notice of a water right in the Box Canon in the Nisqually River with the county auditor, laying claim to 35,000 cubic inches of water per second. The claim is located about three miles up the river, and in the notice filed declares the right to use the water by flume or tunnel for power or irrigation purposes.

PROSSER, WASH.—Messrs. Smith and Olsen, who some time ago purchased 950 acres of land under the canal extension within two miles of Prosser, for the purpose of establishing a colony, are negotiating with the Prosser Falls Land & Power Company to secure electricity for lamps and motors for the residents of the colony.

PIEDMONT, W. VA.—The Piedmont Railway Company has applied for a street railway franchise on Fairview Street, in connection with the proposed electric railway connecting Piedmont and West Virginia Junction, W. Va., and Luke and Bloomington, Md., a distance of about two miles.

JEWETT CITY, CONN.—A new gasoline engine is being installed in the municipal electric light plant. The transmission lines of the municipal electric plant are being extended from this borough into Sylvandale, where lamps will be installed in the residence of James O. Sweet. Franklin G. Waters is superintendent.

RENO, NEV.—The Virginia & Truckee Railway Company is planning to equip its road, to be operated by electricity between Reno and Carson. It is understood that the overhead system will be used to the city limits and the third-rail system the remainder of the route. It is said that work will commence soon on the project so as to be prepared for the summer traffic to the resorts between the two cities.

ESCONDIO, CAL.—At a mass meeting held recently the citizens voted to instruct the City Trustees to secure an approximate cost of establishing a municipal electric light plant, and it is expected that a special election will soon be held to vote on the proposition.

ARCATA, CAL.—The California Barrell Company has installed a 40-hp motor in its plant to operate the machinery, and if satisfactory, will install more and larger motors to take the place of its steam plant. Electricity for operating the plant is furnished by the North Mountain Power Company, of Eureka, through A. B. Brizard & Company, of Arcata, the local agency.

OSAKIS, MINN.—Frank H. Cannada has been granted a franchise to erect a telephone exchange in this town.

COVINGTON, KY.—The property of the Independent Telephone Company, owned by S. P. Kineon, was sold at public auction March 11 to Attorney U. J. Howard for $2,400, who represented a number of the creditors. The property consists of telephone lines in Kenton, Campbell and Pendleton counties, with exchanges at Butler, Falmouth and Grant's Lick.

COLUMBUS, OHIO.—The new 1000-kw turbine at the municipal electric light plant will soon be placed in operation. Two new 300-hp boilers are also being installed. The new equipment will be sufficient to provide for the present needs of the plant. The Service Board is now planning to install 200 more lamps on the various circuits, which will require an expenditure of from $8,000 to $10,000.

GENEVA, N. Y.—The Board of Public Works has granted the Economic Power & Construction Company permission to enter the city conduits, and a contract has been entered into whereby the company rents two ducts for a term of 20 years at the annual rental of five cents per duct foot. The contract calls for 5515 feet, starting April 1, and as many more from time to time as the company may need. B. L. Jones, of Buffalo, is president of the company.

NASHVILLE, TENN.—The City Council has passed an ordinance appropriating $100,000 for enlarging and improvements to the municipal electric light plant, for which plans and specifications are now being prepared. J. W. Dashiell is secretary of Board of Public Works.

JESUP, GA.—A charter has been issued by the Secretary of State to the Goose Creek Railway & Power Company. The company is capitalized at $250,000, and proposes to construct an electric railway from Jesup to Docktown, a distance of about 24 miles, and to equip and operate an electric light and power plant. The incorporators are H. W. Whaley, F. E. Breen, S. E. Cohen, W. M. Boberson, of Jesup, and D. G. Zeigler, of Columbia, S. C. D. G. Zeigler is chief engineer.

CHIHUAHUA, MEX.—The Compania Electrica y de Ferrocarriles de Chihuahua has been organized with a capital stock of $2,200,000. The company will take over the Mineral Railroad Company, the street railway company and the plant of the Industrial Electric Company. The company proposes to convert the Mineral Railroad from steam to an electric line, and also to operate the street railway lines by electricity. An electric power plant with sufficient output to furnish electricity for operating the railways and for lighting the city will be erected by the company. Enrique C. Creel is president of the company, and A. C. Nash is general manager.

SASKATOON, SASK.—The Saskatchewan Power Company has applied for articles of incorporation with a capital stock of $1,000,000 to construct a power plant on the Saskatchewan River at this place. J. F. Cairns, of Saskatoon, is interested in the project.

PINE BLUFF, ARK.—At the annual meeting of the Citizens' Light & Transit Company the following-named officers were elected: J. F. Rutherford, president; D. C. Bell, first vice-president; R. L. Rutherford, second vice-president; W. T. Young, secretary, and F. E. Cherot, treasurer. Plans are now being made to double track the Sixth Avenue line.

FINDLAY, OHIO.—At the annual meeting of the Home Telephone Company the following-named officers were elected: J. C. Bright, president; T. J. Collingwood, vice-president, and H. W. Stoker, secretary and treasurer.

FITZGERALD, GA.—The organization of the Fitzgerald & Ocilla Electric & Power Company has been completed and the following-named officers elected: S. Tilden Holtzendorf, president; B. F. Holtzendorf, first vice-president; W. T. Whitley, second vice-president; A. Holtzendorf, secretary and treasurer. The capital stock of the company is placed at $50,000.

TORONTO, ONT., CAN.—At the annual meeting of the Electrical Development Company the following-named officers were elected: Sir Henry Pellatt, president; Frederic Nicholls, first vice-president, and William R. Mackenzie, second vice-president.

HARTFORD, CONN.—The Connecticut Home Telephone Company, recently incorporated, has been organized by the election of the following-named officers: Lewis Sperry, of Hartford, president; Frank H. Wheeler, of New Haven, vice-president; Harrison B. Freeman, Jr., of Hartford, secretary; R. P. Lyon, of Hartford, assistant secretary, and J. H. Hale, of Glastonbury, treasurer.

Business Notes.

THE RIDGWAY DYNAMO & ENGINE COMPANY, Ridgway, Pa., has opened a district sales office at 907 Andrews Building, Cincinnati, Ohio. Mr. Geo. W. Euker, who has had a varied experience in electrical and power plant work, is in charge as manager.

THE DOUBLEDAY-HILL ELECTRIC COMPANY, of Pittsburg, has doubled the capacity of its winding and repair department in order to handle its increasing business in these lines. New quarters have been leased in the Bindley Hardware Company Building, at Shadyside Station, where direct railroad and express facilities are available. By the addition of more lathes, punching presses and milling machines, the company is in a position to turn out armatures complete if necessary.

THE BULLOCK ELECTRIC WORKS, of Cincinnati, Ohio, drafting and correspondence departments, it is said, will be moved to the plant of the Allis-Chalmers Company at Milwaukee, Wis., sometime in April, so that all special construction work may be done from there. All stock motors and appliances heretofore built in these shops will, however, continue to be built in Cincinnati. The object in removing this department is to concentrate the special work in one plant. There will be no reduction in the working force at the Cincinnati plant.

GOULD STORAGE BATTERY INSTALLATION.—The Gould Storage Battery Company, 341 Fifth Avenue, New York City, has been given a contract to install for William W. Harrison, of Glenside, Montgomery County, Pa., a large storage battery, consisting of sixty cells, Type S-623, in lead-lined tanks. The capacity of this new battery is 220 amperes for eight hours. A battery about equal to this was installed a few years ago, which, with the new one, will make a total of 120 cells. The current from these batteries is used for not only lighting purposes, but also for power.

THE UNITED GAS MACHINERY COMPANY has taken offices in the Engineering Building, 114 Liberty Street, New York City. It has taken over the business formerly conducted by Thos. F. Fitzsimmons at 100 Broadway, and will manufacture a complete line of gas generators for making producer gas for gas engines and heating, and water gas for high temperature furnaces, forges, annealing, etc. Thos. F. Ftzsimmons remains with the company as its president and general manager, and his long experience in the application of producer gas to gas engines and water gas to furnaces, insure to the purchaser the best possible results.

THE ROESSLER & HASSLACHER CHEMICAL COMPANY, 100 William Street, New York, has recently appointed F. A. Croselmire,

formerly president of the Croselmire & Ackor Company, manager of its platinum department. Mr. Croselmire is well known in the platinum trade, having been identified with it, both in this country and Europe, for many years past. It will be the company's endeavor to obtain and develop the friendship and patronage of all who may solicit its services in any way pertaining to platinum, gold and silver refining.

CROSELMIRE & ACKOR COMPANY.—The plant of this company has been purchased, as mentioned in the issue of last March, by Franz Eisenbach & Company, the home address of which firm is Offenbach, Germany, not Berlin, as stated. Messrs. Eisenbach & Company have been connected with the Croselmire & Ackor Company for the past three and one-half years, and during that period have been represented by Mr. Conrad Eisenbach as one of the managers of the business. Mr. Eisenbach, who is now a partner and president and treasurer of the new company, will personally conduct the business on the same basis as heretofore.

GAS ENGINES FOR STEEL FOUNDRY.—During January the Duquesne Steel Foundry, which operates a large plant in the Pittsburg district, decided to adopt the gas power system to operate the works formerly driven by steam. The initial equipment will consist of a 400-hp (max.) Westinghouse gas engine of the three-cylinder, vertical, enclosed type, direct connected to a 240-kw generator which will serve the various motor drives around the plant. The plant will operate on natural gas, which is available in large quantities in the Pittsburg district, for power as well as lighting, at such low rates as to render gas power the cheapest form of power available in this section of the country.

RONEY MECHANICAL STOKERS.—The Westinghouse Machine Company, builders of the Roney Mechanical Stoker, reports for the first two months of this year a good demand for stoker equipments. Perhaps the most interesting orders have come from cold storage companies. The Merchants' Ice & Cold Storage Company, of Cincinnati, are installing three equipments; the Montgomery Ice & Cold Storage Company, Jenkintown, Pa., two equipments, and the Holt Ice & Cold Storage Company, Indianapolis, Ind., the same number. Another municipal lighting station at Troy, Ohio, operated by the Board of Public Service, has adopted Roney stokers, and the Pennsylvania Light, Heat & Power Company, of Allegheny, Pa., operating a large central station at that place, increases its present equipment with two stokers of large capacity. The Mutual Union Brewing Company, Alliquippa, Pa., is installing three equipments, and the Alpha Portland Cement Company, operating a number of plants in the country, one of the largest size.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 10, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

881,108. APPARATUS FOR ELECTROLYSIS OF BRINE; C. F. Carrier, Jr., Elmira, N. Y. App. filed April 25, 1907. An electrolytic cell having decomposing and oxidizing compartments, means for circulating mercury therethrough, and a distributing slot for mercury substantially centrally disposed in the decomposing department.

881,114. ELECTRIC VIBRATOR; J. M. Dinkins, Indianapolis, Ind. App. filed July 21, 1906. A form of vibrator bell for large gongs in which the clapper strikes on the interior surface, rather than on the periphery of the gong.

881,138. ELECTRIC BLOCK-SIGNAL; E. P. Matter, Alexandria, Va. App. filed May 13, 1907. Patentee has a brush depending from the locomotive cab which engages a contact plate to establish an alarm signal in the cab in case the semaphore is set at danger.

881,181. BATTERY HOLDER; E. S. Egge, Montgomery, Ala. App. filed Aug. 14, 1907. Has a socket to receive a dry cell with spring-impelled contact buttons, which automatically connect the batteries in series when they are inserted in inverted relation in the sockets.

881,235. GAS IGNITER; C. T. Giorgi, Florence, Italy. App. filed Oct. 5, 1904. Renewed Feb. 1, 1908. A complete construction of gas lighter making use of a magnet coaxial with the tube of the burner and which attracts a laterally movable armature, which operates a turn cock, and heats a platinum filament to ignite the gas.

881,247. ELECTRIC PUMP REGULATOR; A. Koesche, Chicago, Ill. App. filed Sept. 13, 1907. A pump regulator for air compressor systems having a switch element which is abruptly displaced by toggle levers when a predetermined pressure against a piston is exceeded.

881,264. ELECTRIC SIGNAL DEVICE; E. Schermerhorn, Amsterdam, N. Y. App. filed Sept. 1, 1906. A pocket device, including dry cells, and a miniature electric lamp, and also having a telegraph sounder. The light may be flashed with the telegraph signals.

881,284. WALL BRACKET FOR ELECTRIC LIGHTS; W. R. Atkinson, New York, N. Y. App. filed April 23, 1907. A porcelain housing having a lamp receiving portion or socket at right angles to the plane of the surface on which it is received.

881,297. SOCKET FOR ELECTRIC LAMPS; C. G. Burton, Peru, Ind. App. filed March 14, 1907. A socket having a switch element of the ordinary turn button type, and including special features for locking the parts of the casing together.

881,300. ELECTRIC SWITCH; E. M. Coffin, Oakland, Cal. App. filed March 7, 1906. Two-button snap switch having a spring-impelled switch element retained from movement by a detent which is displaced by the button at the end of a predetermined inward movement.

881,306. ELECTRIC SWITCH; G. Cutter, South Bend, Ind. App. filed June 13, 1906. A rotary snap switch making use of knife blade switch elements movable in the plane of rotation of the handle and abruptly moved to complete their throw by a spring-impelled roller engaging a cam surface.

881,344. ELECTRICAL SIGN RECEPTACLE; F. J. Russell, New York, N. Y. App. filed April 5, 1907. A receptacle for use in electric signs and similar relations where the socket is secured in a perforation of the sheet metal support. Makes use of a pair of porcelain cups which nest together from opposite sides of the sheet metal support. The inner cup receives the threaded shell.

881,359. TROLLEY POLE CONTROLLER; C. R. Traxler et al., Winston Salem, N. C. App. filed April 16, 1907. A trolley pole controller comprising a weight for attachment to a trolley pole cord, and a tubular guide for the weight in its vertical movements.

881,360. TELEPHONE-RELAY; C. W. Underwood, Crowley, La. App. filed July 6, 1907. In a telephone-relay, a telephone receiver magnet and coils, a telephonic transmitter, an armature in operative relation to the telephone receiver magnet and mechanically connected to the transmitter element, and a wire support for the armature having a localized central connection thereto, said wire being under longitudinal strain or stress.

881,371. ELECTRICAL PLUG AND RECEPTACLE; P. C. Brown, Boston, Mass. App. filed Oct. 20, 1906. A screw socket plug connection having a detachable construction, whereby the jack position can be inserted by a direct movement, whenever desired.

881,387. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; A. C. Eastwood, Cleveland, Ohio. App. filed March 6, 1907. A complete multiple control system for trains designed to make use of direct current at low voltage for individual motors, and establish a complete control by which their voltage is low at starting without the use of resistances .

881,404. ELECTRIC ESCAPEMENT FOR TIME MOVEMENTS; C. F. Hollister, Waterbury, Conn. App. filed March 25, 1907. A secondary clock, including a magnet displaced escapement.

881,410. VALVE STEM AND THE DEFLATION ALARM; A. E. Kay, Chicago, Ill. App. filed Aug. 3, 1906. Patentee has a specially constructed valve for automobile tires with a plunger which is depressed to establish an alarm circuit in case the tire flattens.

881,453. APPARATUS FOR PROTECTING GRAIN STACKS; J. P. A. Anderson, Madrid, Ia. App. filed Feb. 25, 1907. A canvass covering for a grain stack with flexible lightning conductors embodied therein from which circuits are established to the ground.

881,456. DYNAMO ELECTRIC MACHINE; Henry Berg, Orange, N. J. A ventilated construction for armatures of dynamo electric machines making use of propeller blades at the ends of the armature which maintain a continuous current of air therethrough.

881,464. EXPRESSION DEVICE FOR KEYBOARD MUSICAL INSTRUMENTS; J. W. Darley, Jr., Baltimore, Md. App. filed Dec. 13, 1905. A switch controller adapted to put different sound devices in circuit with a keyboard by the operation of suitable stops on the instrument.

881,470. TROLLEY; C. Harkness, Providence, R. I. App. filed Nov. 28, 1906. The harp carries a table swiveled on a vertical axis and from which there projects upward a pair of trolley wheels.

881,517. ELECTRIC FURNACE; C. E. Wilson, Ferris, W. Va. App. filed Sept. 16, 1906. In an electric furnace, the combination of a melting receptacle provided with main electrodes, and an exciting electrode movable between the main electrodes, toward one and away from the other, for the purpose set forth.

881,518. ELECTRIC FURNACE; C. E. Wilson, Ferris, W. Va.; App. filed Sept. 15, 1906. Modifications of the above.

881,519. ELECTRODE-HOLDER FOR ELECTRIC SMELTING FURNACES; C. E. Wilson, Ferris, W. Va. App. filed Sept. 15, 1906. An electric-furnace, current-distributing holder for a plurality of pencil electrodes, comprising, in combination, a head having pencil receiving openings through it, electric current conducting means connected with the head, and a pencil-support comprising current-conducting pencil engaging and releasing clamping means on the head at each of said openings.

881,520. SECTIONAL ELECTRODE FOR ELECTRIC FURNACES; C. E. Wilson, Ferris, W. Va. App. filed Sept. 15, 1906. A pencil-electrode section for electric furnaces, formed of separate longitudinally extending members, fitting closely together at adjacent sides and provided at opposite ends with means for clamping the members together, and for securing the sections endwise to other sections.

881,527. PROCESS FOR TREATING COMPLEX COBALT ORES AND FOR REFINING COBALT FROM NICKEL, ARSENICAL AND SILVER BEARING ORES; E. E. Armstrong, Niagara Falls, N. Y. App. filed May 1, 1906. The process of separating cobalt which consists in electro-chemically precipitating the cobalt as oxid by treating a solution of the same to electrolysis in the presence of a halogen salt of a metal.

881,531. CURRENT COLLECTOR FOR THE THIRD RAIL OF ELECTRIC RAILWAYS; J. G. Baukat, White Plains, N. Y. App. filed Aug. 24, 1907. A contact shoe or trolley for electric trains which can be reversed on its clamping devices so as to engage the third rail on its upper or underneath surface.

881,533. STERILIZING; E. P. Beckwith, Cazenovia, N. Y. App. filed Nov. 9, 1905. Means for purifying or sterilizing water with ozone and for treating air to produce ozone for use in sick rooms and similar places. Makes use of a nest of perforated tubes through which the current of air flows and in which it is exposed to an electric discharge.

881,539. ELECTRIC BELL; D. M. Bliss, New York, N. Y. App. filed March 1, 1906. All of the windings and contacts are hermetically sealed in a brass casing through the wall of which the magnet poles project to act upon the clapper armature. The device has a supplemental vibrator within the casing to avoid the usual vibrator contact on the clapper armature.

881,565. SAFETY LIMIT SWITCH; H. A. Everett et al., Barrington, N. J. App. filed July 23, 1907. A means for preventing the chain plug on an electric hoist from assuming a jamming position to the structural work of said hoist, and thereby preventing the breaking of the chain or wire rope, or causing injury to the electric motor or motors or wiring connected thereto.

881,580. METHOD OF RECOVERING COPPER FROM ORE OR MATTE BY ELECTROLYSIS; Henry K. Hess, Philadelphia, Pa. App. filed Jan. 31, 1907. The herein-described process of recovering copper from natural ore or matte consisting in immersing porous

briquets containing particles of comminuted ore in an electrolyte together with a lead electrode in permanent contact with the briquets and subjecting the same to the action of an electric current for the liberation of the copper.

881,585. ELECTRIC-MOTOR; E. Hopkinson et al., Manchester, England. App. filed Dec. 29, 1905. An electric motor of the induction type having a plurality of rotors mounted to revolve about the separate axis, and a magnetic system common to and arranged to extend symmetrically around said rotors in a direction transverse to their axis and to act equally and simultaneously upon diametrically opposite parts of such rotor.

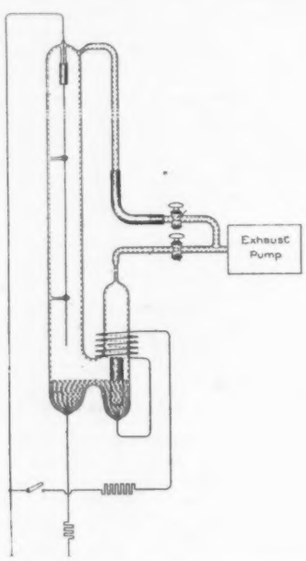
881,587. TROLLEY WHEEL PLACING DEVICE; H. G. Husted, Oberlin, Ohio. App. filed July 29, 1907. Makes use of a small supplemental roller with spiral grooves running from each end toward its center and which is designed to reposition the trolley wheel beneath the wire so that it may be easily engaged while the car is running.

881,588. METHOD OF EXHAUSTING VAPOR-CONDUCTORS; A. M. Jackson, Schenectady, N. Y. App. filed Aug. 4, 1903. The method of exhausting a vapor electric apparatus, which consists in conducting the exhaustion from a pair of communicating chambers simultaneously, and maintaining an arc while the exhaustion is in progress.

881,596. ELECTRIC CARRIER; S. H. Libby, East Orange, N. J. App. filed May 18, 1906. An electric crane having a plurality of electric carriers to run upon the same track. Includes means for preventing a collision between the carriers.

881,628. TELEPHONE CUT-OUT; E. W. Smith, New York, N. Y. App. filed July 12, 1907. In a telephone system, the combination with a plurality of lines and a main line, of a plurality of magnets one for each party line connected with the main line, an armature normally in circuit with the main line and the party lines, and means whereby the armature may be made to break the circuit with any of the party lines.

881,635. CAR SIGNAL SYSTEM; D. P. Thomson, Schenectady, N. Y. App. filed Aug. 2, 1907. The track rails are made continuous throughout their entire length so as to serve their return current carrying function. At intervals sources of alternate current of different periodicity are alternately connected. The locomotive carries a sensitive coil in inductive relation to the track and which is in a telephone circuit within the cab. The engineer can tell by listening to the character of the hum in his receiver whether he is getting



881,588.—Method of Exhausting Vapor-Conductors.

current from one or two blocks away, depending on where the track rails ahead are short-circuited by the preceding train.

881,636. BALANCES SET; L. E. Underwood et al., Lynn, Mass. App. filed Oct. 1, 1904. Electric distribution of the three-wire type in which compensating machines are used to balance the load between two main conductors and the neutral wire of the three-wire circuit.

881,642. ELECTRIC RELAY; E. Weston, Newark, N. J. App. filed June 21, 1904. An electric relay in which the movable contacts carried by the relay armature close local circuits on stationary front and back contact stops, the armature being actuated by magnets on opposite sides.

881,647. SELF-EXCITED ALTERNATOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Feb. 19, 1906. In a self exciting alternator, a main armature winding, an auxiliary winding, a field magnet, a field winding carried thereby provided with a rectifying commutator, brushes bearing on said commutator and connected to said auxiliary winding, and short-circuited conductors surrounding each pole and the spaces between poles.

881,663. FIRE ALARM; G. H. Carroll, Vacaville, Cal. App. filed Nov. 9, 1907. Patentee makes use of a cord connected at one end to a circuit-closing device and at the other end to a coil spring whereby its stretch and slack are taken up under ordinary circumstances. In case of a fire, the cord is burned and the circuit-closing device actuated.

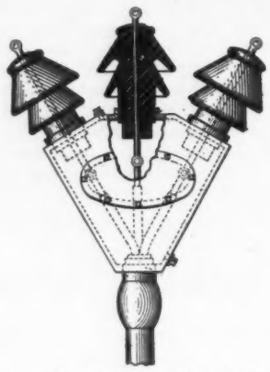
881,682. SHIELD FOR THE USE OF LINEMEN; G. E. Harrison et al., Detroit, Mich. App. filed Aug. 1, 1907. A device adapted to be placed over potential wires of a transmission system when the lineman is on the pole to protect him from the high voltages.

881,683. ELECTRICAL SOCKET SEAL; L. T. Hatfield, Sacramento, Cal. App. filed Aug. 3, 1906. A small paper device adapted to be inserted in a lamp socket, and constitutes a seal to prevent the insertion of a lamp without first destroying the seal.

881,686. ELECTRIC SWITCH; S. Hoadley, Gosport, Ind. App. filed Aug. 12, 1907. Means whereby a telephone may be switched into and out of connection with either one of two exchanges, and in which an extension or separate bell is used for the subscriber, so that he may not be called from one exchange until he has finished communication with the other.

881,712. TELEPHONE-RECEIVER; H. G. Pape, New York, N. Y. App. filed June 16, 1904. Renewed Jan. 25, 1908. In a receiver, the combination with a casing divided to form front and rear compartments, of an armature in one compartment, a diaphragm in the other compartment, a magnet having an inclosing shell screwed into the dividing wall of the casing, and a connection passed through the magnet between the armature and the diaphragm.

881,765. STARTING DEVICE FOR MERCURY VAPOR ELECTRIC LAMPS; L. A. Audibert, Lodeve, France. App. filed Sept. 14, 1906.



881,777.—Terminal for Electric Cables.

A means for starting mercury vapor lamps by preliminary contact. Makes use of a magnet displaced filament which dips into the mercury at starting.

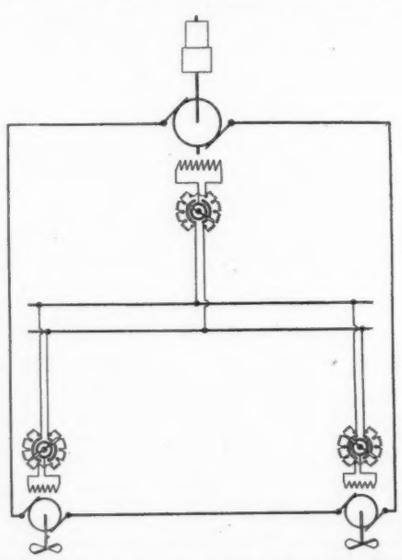
881,777. TERMINAL FOR ELECTRIC CABLES; C. W. Davis, Edgeworth, Pa. App. filed March 31, 1906. A conduit connection for three-wire, high-voltage transmission systems making use of a housing from which there project three petticoated insulators through which the circuit wires are received from the conduit.

881,810. ELECTROPLATING APPARATUS; G. A. Lutz, New York, N. Y. App. filed April 8, 1907. An electroplating apparatus comprising a tank for an electrolyte, a series of anodes suspended within said tank, a post within said tank located within said series of anodes, anodes suspended from said post, means for connecting all of said anodes in a circuit, and a cathode plate provided with means to support articles to be plated and arranged to suspend said articles in the space between said series of anodes.

881,811. ELECTROPLATING APPARATUS; G. A. Lutz, New York, N. Y. App. filed April 8, 1907. The combination of a tank for an electrolyte, means for suspending an article to be plated therefrom, means for suspending an anode from said cathode, and means for insulating the anode from said cathode.

881,840. INSOLE FOR BOOTS AND SHOES; J. Askins, Lima, Ohio. App. filed Sept. 23, 1907. Makes use of electrolytic action to cause the absorption of moisture from the foot in use.

881,847. THERMOSTAT; F. P. Butman, Holbrook, Mass. App. filed March 27, 1903. A small metallic housing adapted to be secured in



881,864.—Means for Transmitting Power Electrically.

the wall at points to be protected and having a spring-impelled plunger, movement of which is resisted by a fusible substance.

881,864. MEANS FOR TRANSMITTTING POWER ELECTRICITY; G. Lewin, Schoenberg, Germany. Covers the synchronous operation of two twin-screw propellers of a boat by the use of a third generator controlling the field excitation of each propelling generator.

881,878. TELEPHONE-SWITCH; A. N. Wright, Jackson Center, Ohio. App. filed July 8, 1907. Plug switch analogous in construction to plugs of a resistance box.

881,880. GALVANOMETER; S. G. Brown, London, England. App. filed April 7, 1903. Provides means for indicating whether a circuit in which the galvanometer is included possesses self-induction or capacity.